The American Journal of Surgery

EDITED BY THURSTON SCOTT WELTON, M.D.

April 1944

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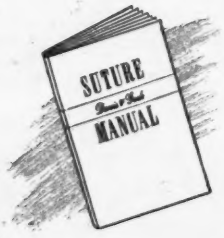

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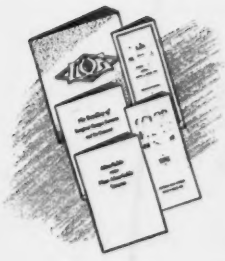

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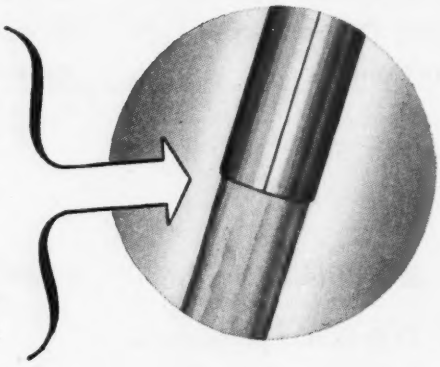

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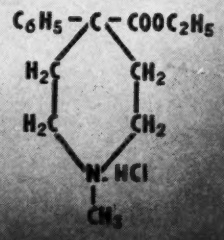

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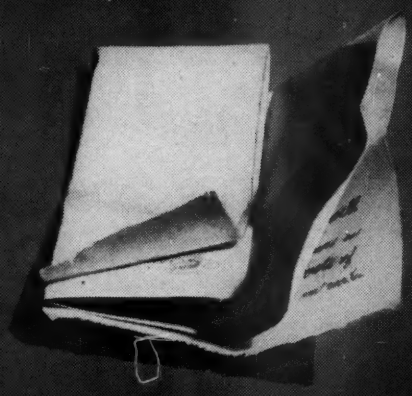
AN OLD FAMILY RECIPE THAT BECAME MEDICAL HISTORY



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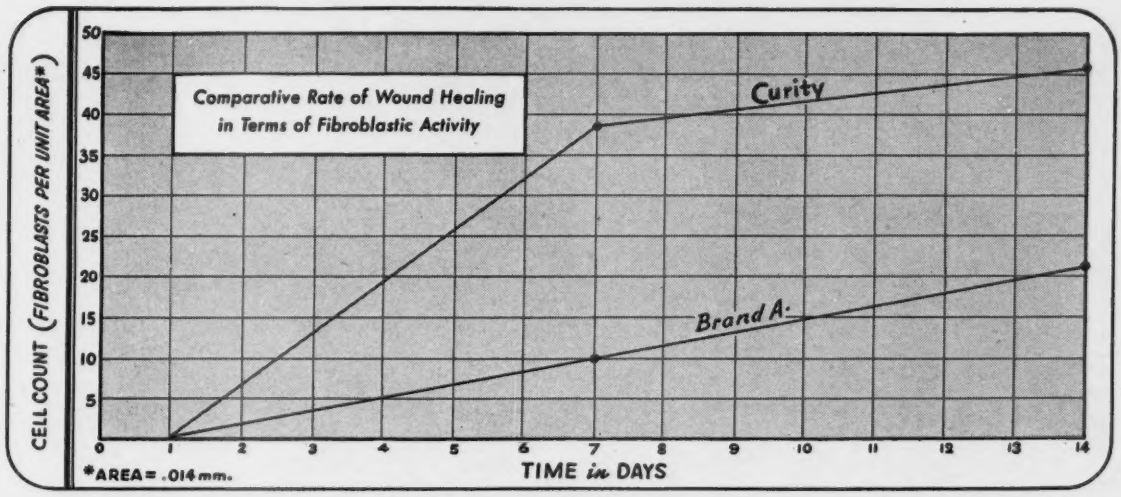

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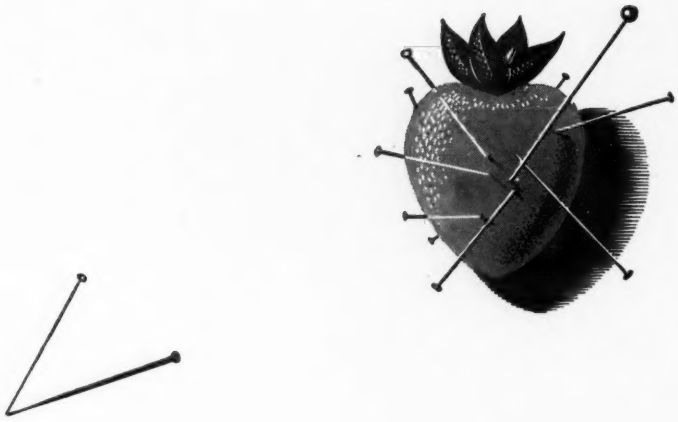

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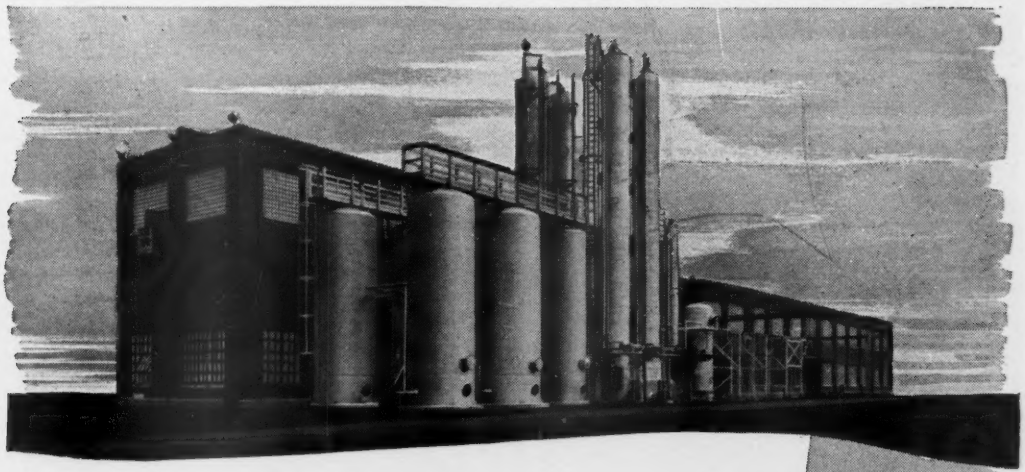

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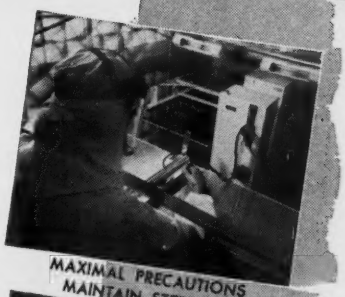

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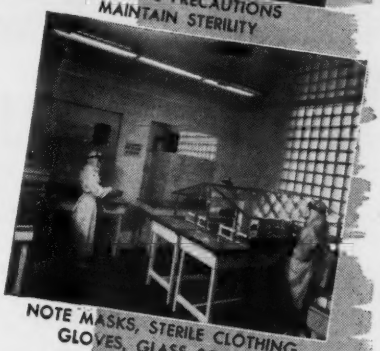

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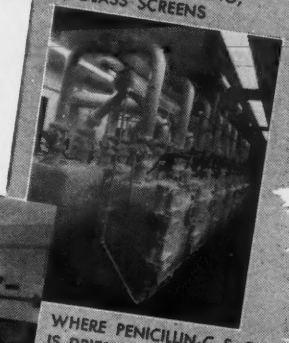

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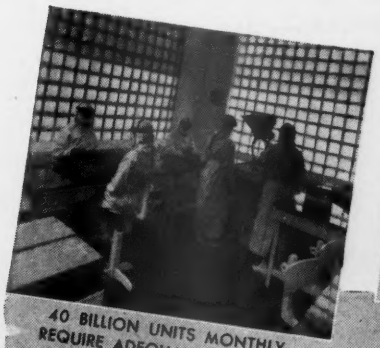

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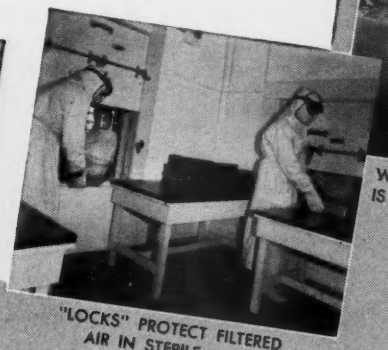

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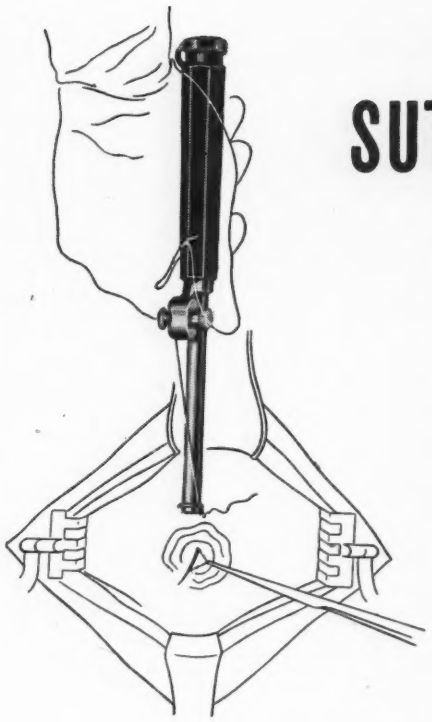

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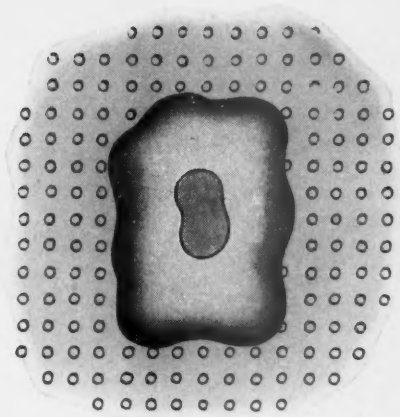
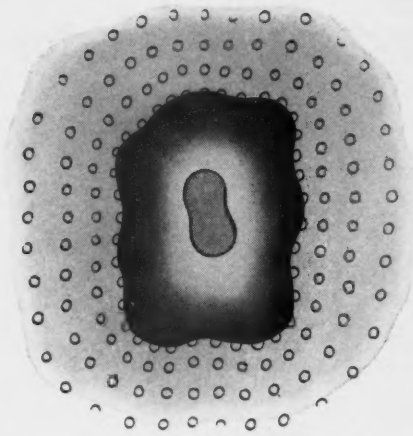


Germicide which does not lower surface tension is slower to diffuse through cell wall. Molecules of germicide are distributed uniformly throughout the solution.



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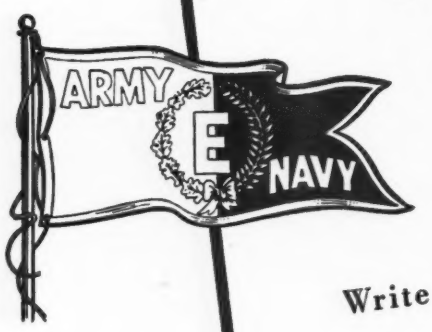

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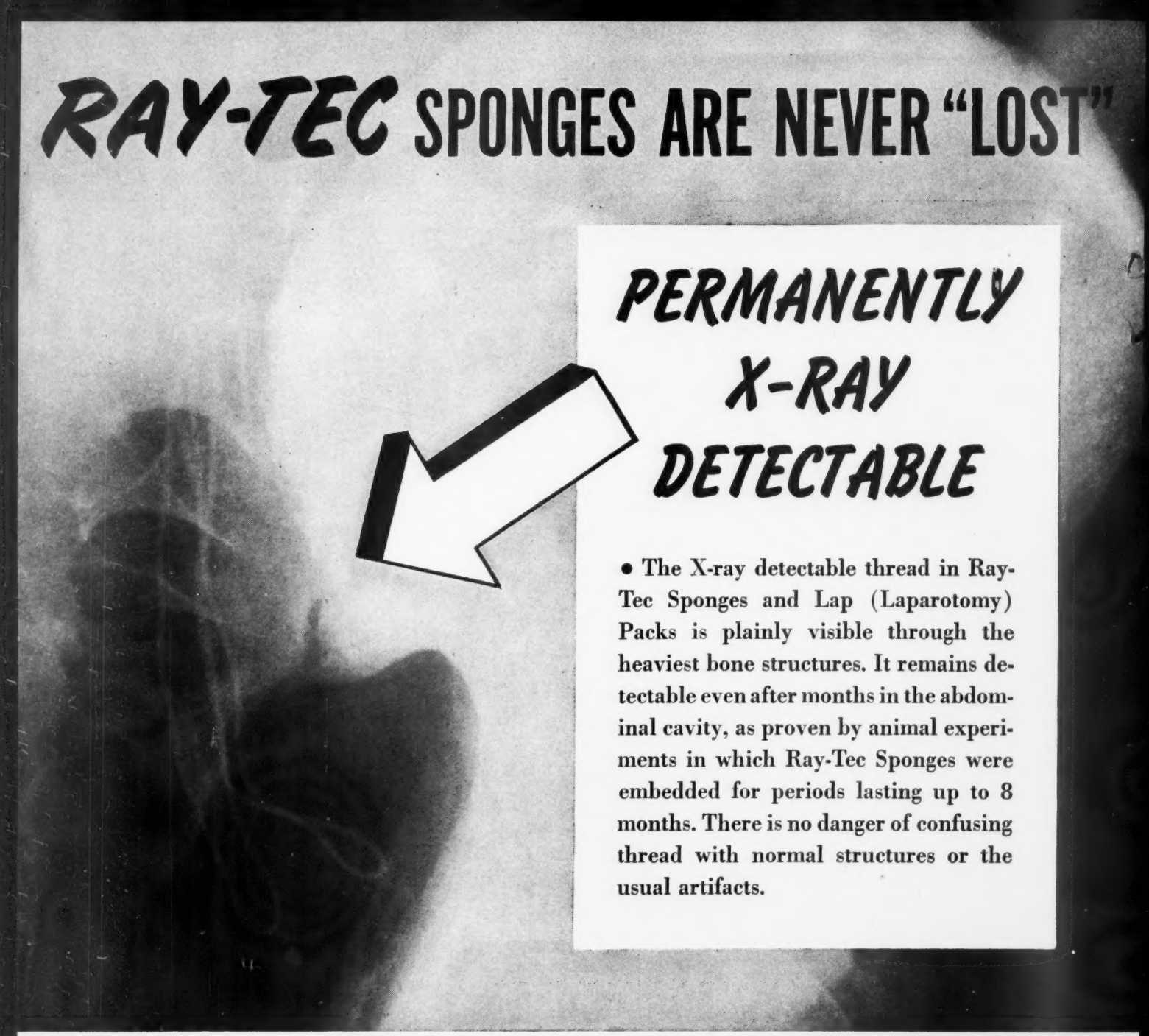

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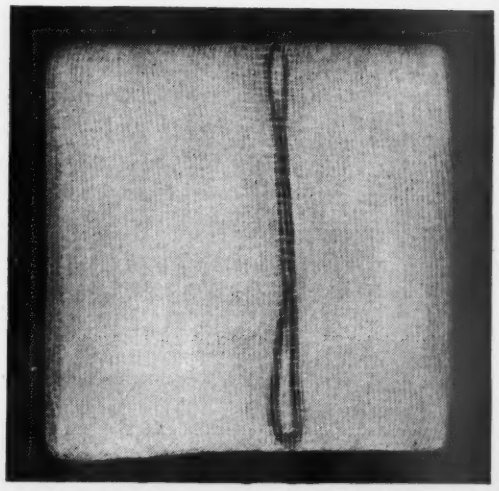

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Editorial

FUNDAMENTALS OF HERNIOPLASTY

THE surgical literature of the past two decades has offered many articles about inguinal hernias. There have been reported careful dissections of the inguinal regions with newer concepts of old anatomical details. Numerous modifications of old methods of repair have been offered and new technics suggested. In so many of these discussions, the basic details of hernia repair have been hastily passed over or not mentioned at all. These fundamental details which were described by the surgeons of the preceding generation, still remain the bulwark of satisfactory hernia repair. For the younger surgeon, who perhaps is a little confused by the great volume of writings, a careful study of these details is urged, for it is only in light of them that any of the newer procedures should be considered.

The first principle is to make an adequate incision. So often we see the surgeon attempting to work through a small incision—almost a button hole—as if the size of the final scar was important. A generous incision, four to five inches in length is essential if satisfactory repair is to follow. It should commence well above the location of the internal abdominal ring and be carried down to the external or subcutaneous ring. The location of this incision is important, too. If it is placed low, there remains insufficient of the aponeurosis of the external oblique to suture easily; if it is too far above the canal, the problem of dealing with the internal oblique or the falx may be difficult. Usually the most satisfactory location is one inch above and parallel to the inguinal ligament. In operating upon strangulated or incarcerated hernias, so often these facts are overlooked and the incision is made over the bulging area, thereby causing difficulty of repair.

Adequate exposure and wide dissection of layers with careful identification of all structures is likewise very important. This can be accomplished only by slow and painstaking work. Tissues must be treated with respect if we wish them to heal kindly and with the minimum of reaction. Forceful tearing, application of powerful clamps and unnecessary handling of tissues must all be avoided. Dissection of the various layers must be carried out widely enough so that approximation can later be done without tension.

Complete hemostasis is most important. Even the smallest of bleeders should be controlled by ties for the accumulation of serum in the wound predisposes to tension and is an excellent medium for bacterial growth. Particular attention to this detail, when using spinal anesthesia, is required; for with the lowered blood pressure many small vessels cease bleeding temporarily,

only to open up again when the pressure rises.

Careful and high dissection of the sac is also a fundamental. Extraperitoneal fat should be carefully removed from the neck so that closure is secure. The bladder may have to be freed from the sac. Intraperitoneal attachments of intestine or omenta must be liberated. Hesselbach's triangle should be explored with the finger from within to make sure that there is not another peritoneal pocket in this area as so frequently occurs. To leave such a pouch means almost certain recurrence. A maneuver which facilitates disposal of this extra sac is to pull it through beneath the inferior (deep) epigastric vessels, thereby converting the two sacs into one large one. Twisting of the sac makes high ligation simple; in other instances, the sac may have to be trimmed off as high as possible and closed with a running suture.

The surgeon should be familiar with the basic details of the several types of repair. He should reserve the Coley-Ferguson procedure for children or for adults in whom it is necessary to maintain the length of the cord if there is incomplete descent of the testis also present. He should realize that the modified Bassini technic is indicated only for simple hernias and when structures approach the normal. He must appreciate that for all recurrent or difficult hernias, the Halsted method with subcutaneous transplantation of the cord, is the most satisfactory. Likewise he should be familiar with the variants of these operations and especially the imbrication modifications. Lastly, he should be capable of utilizing fascial transplants or fascial sutures if needed. Hernia repairs are not easy; they are not operations to be delegated to the interne; they require the maximum of knowledge and judgment.

When it comes to the use of suture material, I do not believe that the kind of material used is important. What is important is the size of the material used and the tension under which it is applied. If one prefers catgut, by all means use catgut, for it is hard for the catgut surgeon to change to silk or cotton and achieve good results. However, there is no justification for the use of large sized catgut which permits tissues to be pulled together under tension. The purpose of a suture is to hold tissues in approximation until they heal. If it is under tension, the suture either cuts through the tissues or causes pressure necrosis either of which defeats the purpose. Fine catgut, on the other hand, will stand only the minimal strain and so its use is predicated upon adequate dissection with resulting lack of tension; the proper use of fine catgut allows healing to progress in the desired fashion. The same results may be achieved by the use of fine silk or cotton and these materials produced much less tissue reaction.

Careful attention to these fundamentals will enable the surgeon to repair the great number of hernias successfully; newer and less tried procedures may well be reserved for the exceptional cases.

Arthur M. Dickinson, M.D.

Original Articles

GENITAL FISTULAS IN WOMEN*

THE LIFE OF J. MARION SIMS AND THE HISTORY OF VESICOVAGINAL FISTULA—MANAGEMENT OF RECTOVAGINAL FISTULAS AND COMPLETE TEARS OF THE PERINEUM

LOUIS E. PHANEUF, M.D.
Director of the American Board of Obstetrics and Gynecology
BOSTON, MASSACHUSETTS

THE history of medicine, to which the medical student turns for inspiration, and the busy physician for solace and comfort, contains the names of many illustrious Americans who, because of their untiring efforts and genius, have added to the cause of the cure of disease and have thereby benefited mankind. Some of these men worked in the laboratory, in the field of pure scientific research, whereas others as practitioners of medicine applied the fruits of this research to allay human suffering and save human lives, and still others devised surgical procedures with the same end in view.

The first portion of this article deals with the life of J. Marion Sims, who was such a great American physician. The history of his life shows how what appear to be insurmountable obstacles may be overcome. The story of the development of his operation for the cure of vesicovaginal fistula, one of the most distressing maladies affecting womankind, stands out as an epic of American medicine. The second part deals with the management of rectovaginal fistulas and complete tears of the perineum, the two conditions being closely associated since the former is frequently the result of improper healing of the latter. The name of no single eminent surgeon is connected with this second lesion. However, the names of a number of surgeons who have worked patiently and diligently stand out. Each one of them has added something to the sum total of practical knowledge necessary to make its surgical repair successful.

NOTES ON THE LIFE OF J. MARION SIMS AND ON THE STORY OF VESICOVAGINAL FISTULA

J. Marion Sims was born ten miles south of the village of Lancaster, Lancaster county, South Carolina, on January 25, 1813.[2] The ancestors of his father, John Sims, were of the English colonists of Virginia. His mother, Mahala Mackey, was of Scotch-Irish origin.

Sims graduated from Columbia College, South Carolina, in 1832. In February, 1833, he began to read medicine with Dr. Churchill Jones, of his home town, to the great disappointment of his father, who wanted him to study law. He arrived in Charleston on November 12th of that year and began to study medicine at the Charleston Medical College, registering for a term of lectures. The term concluded at the end of February, 1834, and Sims returned to Lancaster and resumed his studies with Dr. Jones. The last of the

* The Charles Sumner Bacon Lectures for 1943–1944, University of Illinois, College of Medicine, Chicago, December 1 and 2, 1943. From the Department of Gynecology, Tufts College Medical School, and the Department of Obstetrics and Gynecology, Carney Hospital, Boston, Massachusetts.

following September he went to Philadelphia, to continue his studies at the Jefferson Medical College, and travel being by stage it took a week to make the journey. While at Jefferson, Professor McClellan, a great surgeon of his day and the founder of Jefferson Medical College, made a lasting impression on Sims, since he had been privileged to assist him in some of his surgical operations. Sims graduated in March, 1835, but remained in Philadelphia for a month's course of lectures on regional anatomy and surgical anatomy by Professor Patterson, head of the Department of Anatomy at that institution. As he stated, "When I graduated I presume I could have gone into the dissecting room and cut down upon any artery and put a ligature around it, but I knew nothing at all about the practice of medicine."

He returned to Lancaster, South Carolina, in May, 1835, and opened an office on Main Street for the practice of medicine.

Fig. 1. J. Marion Sims, 1813–1883.

His first two patients were children, and both died of cholera infantum. His third patient, whom he treated for delirium tremens, recovered. This patient was the richest man of the town and gave Sims a ten-dollar bill for his efforts.

It took three weeks to go from Lancaster to Mount Meigs, Montgomery County, Alabama, where Sims again started in practice in November, 1835, buying the practice of Dr. Childers for two hundred dollars. In 1837, he accepted a partnership with Dr. Blakey, a planter on a large scale, who wanted to give up part of his practice with the influential people in Macon County, near Cubahatchee Creek. Dr. Blakey at once introduced Sims to a large practice in the Abercrombie neighbor-

hood, and soon he had all he could possibly do. He had been married to Theresa Jones of Lancaster by his college classmate, the Reverend Mr. Thornwall, in December, 1836. He prospered, but because of intermittent fever, which afflicted him and his family severely, he decided, after consultation with his wife, to establish himself in Montgomery, where he arrived on December 13, 1840. He always considered the thirteenth his lucky day or his lucky number. By June, 1845, Sims had been a doctor about ten years. He was then sent by Dr. Henry, of Montgomery, to the home of Mr. Westcott, whose colored servant, Anarcha, had been in labor three days, with the child not yet born. Dr. Henry and Sims found a well developed young woman, seventeen years of age. The child's head was impacted in the pelvis and labor pains had almost completely ceased. The patient was delivered by forceps with no great effort. Five days later Dr. Henry reported that there was extensive sloughing of the soft parts and that the mother had lost control of her bladder and rectum. Sims went to see her and found enormous sloughs from the posterior and anterior vaginal walls. As he wrote, "This case was hopelessly incurable." He went home and investigated the literature of the subject "thoroughly and fully." The next day he met Mr. Westcott and explained to him that

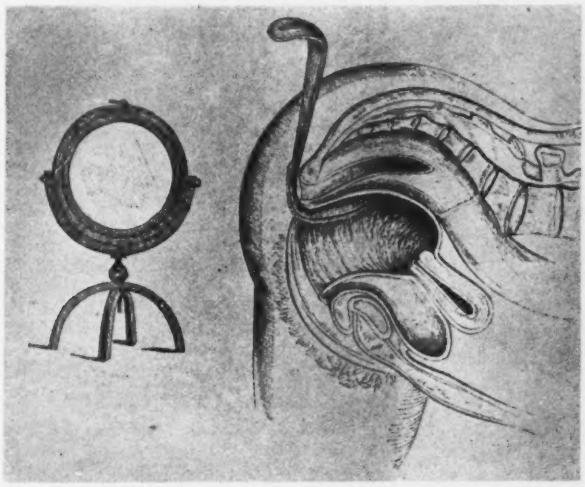

Fig. 2. A mirror eight or ten inches in diameter with which rays of light were directed into the vagina over the surface of the speculum to be reflected on the anterior vaginal wall.

Anarcha had an affliction that unfitted her to perform the duties required of a servant, that she would not die, but that she must be taken care of as long as she lived. This was agreed to by Mr. Westcott. Anarcha's vesicovaginal fistula was the first that Sims had seen.

One month later, Dr. Harris from Lowndes County sent him Betsey, a girl seventeen or eighteen years of age, who had had a baby one month previously. Examination showed that the base of the bladder had been destroyed, and Sims pronounced her case incurable. Still another month later, or two months after Sims had seen Anarcha, Mr. Tom Zimmerman of Macon County sent him his slave girl, Lucy, about eighteen years of age, who had given birth to a child two months previously and was unable to hold her water. At that time Sims had a little hospital consisting of eight beds in the corner of his yard for taking care of his Negro patients and for Negro surgical cases; so when Lucy arrived by train he gave her a bed there. After a minute examination he told her that there was no hope, that she could not be cured,

and that she must go home on the next afternoon.

The following morning Sims was sent for to see a Mrs. Merrill, who had been thrown from her pony. She was an obese woman, weighing two hundred pounds; she was in bed with great pain, which Sims ascribed to an acute retroversion of the uterus. He placed her in the knee-chest position and introduced two fingers into the vagina; the vagina ballooned with air, so that he could not feel its walls, but he was able to push the uterus into the forward position, and when she assumed the reclining position her pain stopped. He had been told in class by one of his teachers at the Charleston Medical College, Dr. Prioleau, of the use of the genupectoral position in the reduction of a sudden version, but up to the time of seeing Mrs. Merrill he had not used it and had forgotten about it. When this patient again assumed the reclining position there was an escape of air through the vagina, accompanied by noise. This inspired Sims with the idea that if the vagina distended with air in a woman in the knee-chest position, by taking advantage of this he might be better able to examine a vesicovaginal fistula and its relations. Giving up the calls that he had to make on twenty patients that morning, he drove home, stopping at a store on the way and buying a pewter spoon. Arriving at his office, where he had two medical students as his assistants, Sims said, "Come, boys, go to the hospital with me." When he got there he told Lucy that he wanted to make one more examination before sending her home. On a table three feet long, upon which was spread a coverlet, he placed her on her knees, with her head resting on the palms of her hands. The students stood on each side of the pelvis. "They laid hold of the nates and pulled them open." Sims writes, "Before I could get the bent spoon handle into the vagina, the air rushed in with a puffing noise, dilating the vagina to its fullest extent. Introducing the bent handle of the spoon, I saw everything as no man had ever seen before. The fistula was as plain as the nose on a man's face. The edges were clear and well defined, and distinct, and the opening could be measured as if it had been cut out of a piece of plain paper. The walls of the vagina could be seen closing in every direction. The neck of the uterus was distinct and even the secretions from the neck could be seen as a tear glistening in the eye, clear, even and distinct, and as plain as could be." He asked himself why these conditions could not be cured. "It seems to me that there is nothing to do but to pare the edges of the fistula and bring it together nicely, introduce a catheter in the neck of the bladder and drain the urine off continually, and the case will be cured." The more he thought of it the more Sims was convinced that he was on the eve of one of the greatest discoveries of the day. He did not send Lucy home, but went to work to invent instruments. The speculum or retractor was clear from the start—the bent spoon.

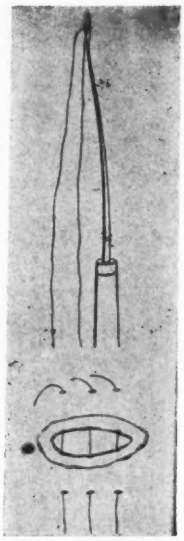

Fig. 3. Push needle employed by Sims and the introduction of the sutures about the fistula.

He sent for Anarcha and Betsey, and he ransacked the country for cases and found six or seven cases of vesicovaginal fistula that had been hidden away for years in the country because they had been pronounced incurable. He added another story to his hospital, which gave him sixteen beds, twelve for patients and four for servants. He then made this proposition to the owners of Anarcha and Betsey: "If you will give me Anarcha and Betsey for experiment, I agree to perform no experiment or operation on either of them to endanger their lives, and will not charge a cent for keeping them, but you must pay their taxes and clothe them. I will keep them at my own expense." In his enthusiasm, he had expected to cure them in six months, so well had he visualized the details of the operation.

It took three months to have the instruments made, to bring in the patients, and to have everything in readiness for operation. The first patient Sims operated on was Lucy, this operation being performed in December, 1845. Her case was a bad one, there being an opening two inches in diameter at the base of the bladder. She was operated on in the knee-chest position, without anesthesia, the operation taking about an hour and being performed in the presence of twelve doctors. Since Würtzer of Germany, in an attempt to cure a fistula, had been unable to keep a catheter in the bladder, Sims introduced a piece of sponge into the neck of the bladder, with a silk string running through it, to draw out the urine by capillary attraction and thus keep the bladder empty. In five days Lucy was very sick; she had a high fever and pulse and signs of blood poisoning. All sutures were cut and removed and there was great difficulty in removing the sponge, which had become incrustrated with urinary salts. The bladder was irrigated and although Lucy was sick enough to die, she rapidly recovered and was well in ten days. After recovery she was examined; the enormous fistula had disappeared, and only two small openings in the line of union across the vagina remained. The problem, therefore,

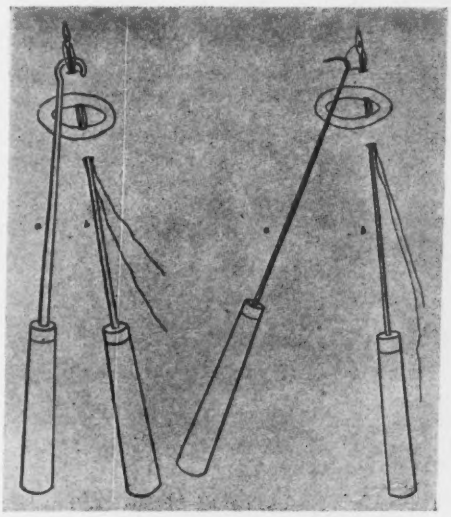

Fig. 4. The technic of introducing the sutures.

was to find something that would draw the urine but would not result in inflammation of the soft parts.

The second patient operated upon was Betsey, who also had a large fistula at the base of the bladder, about two inches in diameter. The operation followed the same technic employed in Lucy's case but a self-retaining catheter was substituted for the sponge. At the end of seven days there had been no chills and fever and the sutures were removed. The operation was a failure but the opening had changed in character. The line of union was in a transverse direction; the fistula was united except for three small openings, one in the center and one at each end.

The third patient to be operated upon was Anarcha. In addition to a large vesicovaginal fistula involving the base of the bladder, she also had a rectovaginal fistula, and, because of the irritation, the external parts had the appearance of confluent small pox. Her condition was pitiful, and, as Sims stated, "Death would have been preferable, but patients of this kind never die; they must live and suffer." Like the two previous cases,

there was imperfect healing, and two or three small openings remained in the line of union.

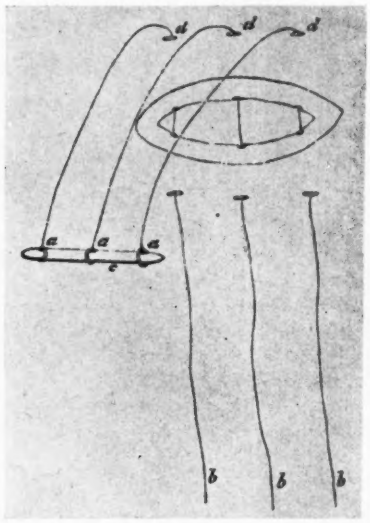

Fig. 5. The placing of the silver wire sutures.

In addition to Lucy, Betsey and Anarcha, Sims had three or four more patients to operate upon, and there was no time when he could not have a subject for operation; but all his operations, so far as a positive cure was concerned, failed. He kept all of these Negroes at his own expense, a considerable task for a young country doctor. With three years of constant failure, the other doctors in the city, who at first were interested and willing to help, became discouraged, and Sims could not get a colleague to help him. Finally, he had to perform these operations with the help of the patients themselves. At this time his brother-in-law, Dr. Rush Jones, advised him to give up his experiments and to devote his life to his practice and to the care of his growing family.

One year after his conversation with Dr. Jones, Sims evolved the method of tying the sutures high in the vagina, where it was difficult to reach, by drawing the ends through a perforated lead shot which was crushed. This method was tried on Lucy. After a month of anxious waiting, examination showed a complete failure. In reasoning out the cause of this failure following his greatly improved technic, Sims came to the conclusion that it might be the suture material that was at

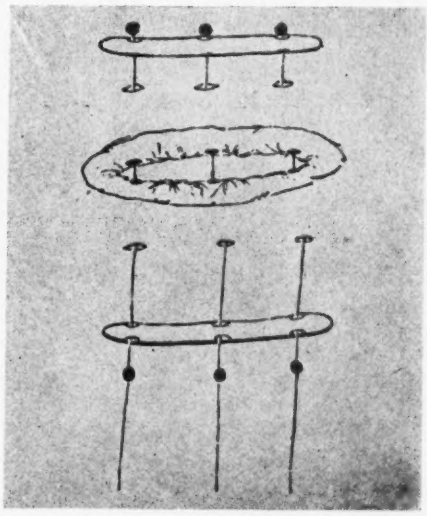

Fig. 6. Silver wire sutures passed through two clamps, one on each side; the fistula ready for closing.

fault. He was looking for a substitute for silk thread. Meltor, of Virginia, had used lead, and Sims had used a lead suture and had failed. "Just in this time of tribulation about the subject, I was walking from my house to the office and picked up a little piece of brass wire in the yard. It was very fine, and such as was used formerly as springs in suspenders before the days of India rubber. I took it around to Mr. Swan, who was then my jeweler, and asked him if he could make me a little silver wire about the size of the piece of brass wire. He said yes, and he made it, he made it of all pure silver."

Anarcha was the patient whose fistula was sutured with silver wire for the experiment. Her fistula, at the base of the bladder, now admitted the tip of the little finger. The edges of the wound were denuded and brought together with four of these fine silver-wire sutures, passed through narrow strips of lead on each side of the fistula, and tightened by crushed perforated lead shots. *This was the thirtieth operation performed on Anarcha.* She was put to bed, a catheter was intro-

duced, and the next day "the urine came from the bladder as clear and as limpid as spring water and so it continued during all the time she wore the catheter." Previously, when silk was used there was cystitis and edema of the urethra and the urine was loaded with a thick, ropy mucus. With silver wire all these were absent. At the end of a week Anarcha was taken from her bed to the operating table. She was placed in the lateral prone position and the speculum was introduced, "and there lay the suture apparatus, just exactly as I had placed it, there was no inflammation, there was no tumefaction, nothing unnatural, and a very perfect union of the little fistula."

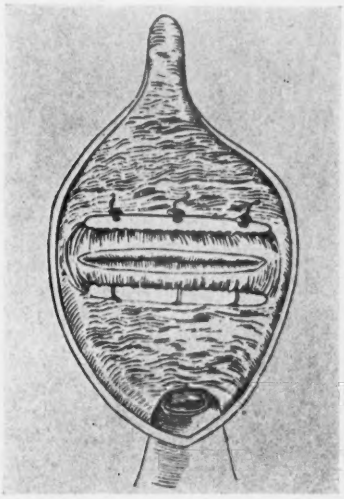

Fig. 7. Edges of the fistula approximated by means of two clamps and held in place by perforated lead shots. (Figures 2 to 7 through the courtesy of *Ciba Symposia*, 5: 1509–1513, 1943.)

This had taken place in May or June, 1849, after four years of experimenting and discouragement. Thus was born the operation for vesicovaginal fistula. In the course of the two weeks that followed both Lucy and Betsey were treated by the same method, without any greater discomfort, and were also cured. Sims then realized that he had made one of the most important discoveries of the age for the relief of suffering humanity.

Six weeks after his success he collapsed as a result of diarrhea, and took his family to Butler Springs. Getting progressively weaker, and seeing no improvement through July, August and September, he went north to New York for a change of climate, returning to Montgomery in October, 1849, and gradually grew worse, the diarrhea being uncontrolled. There followed trips to Cooper's Well for the water cure, to New Orleans and again to New York, with remissions and recurrences of the disease. Sims was unable to work and at last took to his bed believing that he was to die. While in bed he wrote the history of his operation for vesicovaginal fistula. This was published in January, 1852, in the *American Journal of Medical Sciences*.[1]

Fig. 8. The Monument dedicated to J. Marion Sims. George Gray Ward. *Bull. New York Acad. Med.*, 10: 722–724, 1934.

Because the climate of New York seemed to agree with him better than that of Montgomery, Sims sold his house and a partnership in a drug store in Montgomery and left for New York in May, 1853, so near death that no one thought he would reach his destination alive. He had gone to New York for the sole purpose of prolonging his life as he felt better there than anywhere else. With his limited funds he had great financial difficulties. The leading

New York surgeons, having been taught his operation for vesicovaginal fistula and that on the ruptured perineum by him,

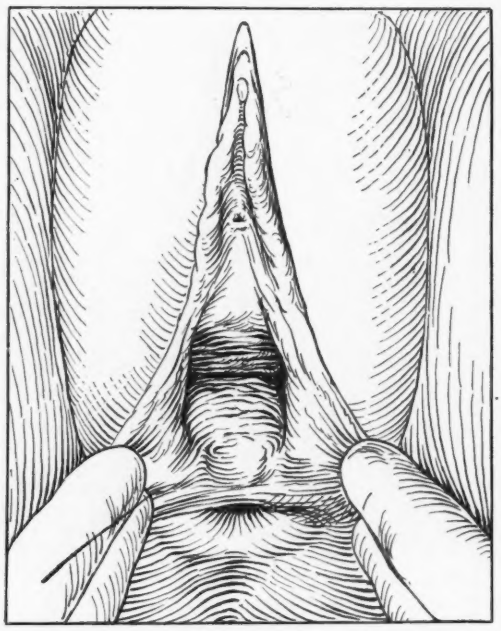

Fig. 9. Complete laceration of the perineum.

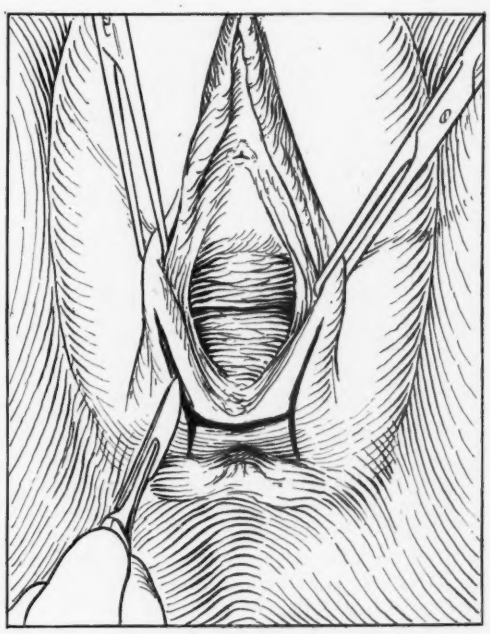

Fig. 10. Incision. The incision takes the form of a capital H. The lateral incision on each side extends from a point below the duct of the vulvovaginal gland to the retracted end of the sphincter. The transverse incision joins the two lateral incisions by running through the scar tissue uniting the rectal and vaginal walls.

consistently ignored him. He had no way of obtaining patients and of making a living. His discouragement was intense and things looked very dark. On meeting a Mr. Beattie, whom he had known well in Montgomery, he related his sad story. Mr. Beattie interested himself in his difficulties and introduced him to a Mr. Henri L. Stuart, of New York, who arranged a meeting at Stuyvesant Hall in May, 1854. There Sims addressed an audience of physicians and lay people who met by invitation, and told them of the necessity of establishing a hospital for women in New York.

Following this meeting Sims obtained the support of a number of influential physicians, some of whom had originally either ignored or opposed him. Again, on the advice of Mr. Stuart and with the aid of a Mrs. Doremus, he proceeded to organize a board of lady managers, which was made up of socially prominent women. They in turn appointed a committee to rent a building and open a hospital as soon as possible. Soon after the meeting the hospital was organized in the home of a Mrs. Codwise on February 10, 1855. Two prominent New York physicians called on Mrs. Doremus and Mrs. Codwise to advise them against their undertaking and to state that such a hospital was not needed, that if established it would not last, and that this work could be performed and was performed perfectly well at the New York hospital. None the less, the hospital was opened, but from the start had no friends among the leading hospital men. Sims states, "I was called a quack and a humbug, and the hospital a fraud."

The Woman's Hospital was inaugurated at 83 Madison Avenue, New York, on May 1, 1855; it had about thirty beds. Mrs. Browne, a widow, and the sister of Mr. Henri L. Stuart, who had done so much in organizing the hospital, was appointed matron and general superintendent. During the months preceding the opening of the hospital Sims' health had been very poor; the diarrhea had returned, he was

extremely weak, and he did not entirely recover until the fall of that year.

The hospital was full from the day it was opened and Sims, despite his illness, performed one operation a day. The hospital was a charity institution, no "pay patients" being admitted. An assistant in the person of Dr. Thomas Addis Emmet soon had to be appointed because of the large amount of work that had to be carried out. Soon after the opening of the hospital Sims' private consultation work increased, manifestly as the result of the work done in this institution. One year after the opening steps were taken to get a charter from the State for the "Woman's Hospital of the State of New York." The charter was obtained in 1857.

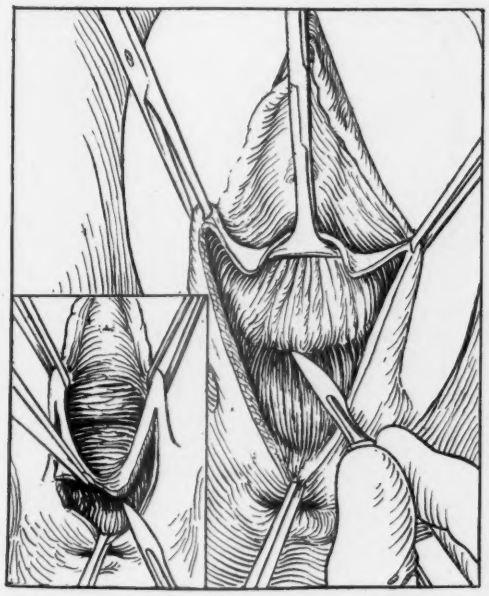

Fig. 11. The vaginal flap has been raised. Exposure of rectum and pelvic slings consisting of the levator ani muscles and their covering fascia.

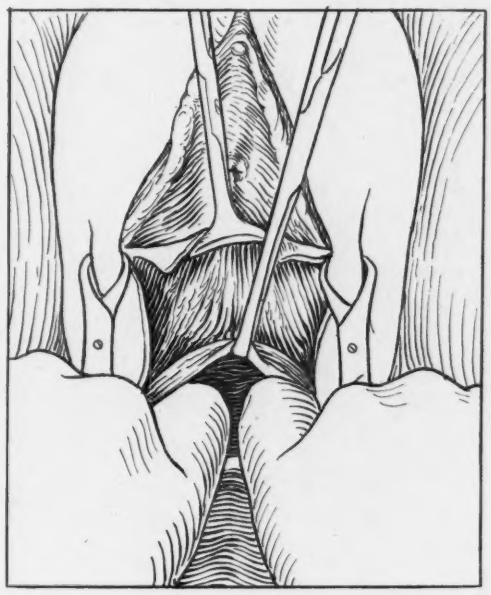

Fig. 12. The rectum is dilated so that it may be approximated without tension.

After the autumn of 1859 Sims had no return of the diarrhea which had weakened him from 1849 to 1855, and his health was reasonably good. Very much in need of a holiday because of his strenuous work, he went abroad for the first time in 1861, arriving at Queenstown on August 31st, and going at once to Dublin, where he stayed ten days and operated for vesicovaginal fistula at the Rotunda Hospital. He was lavishly entertained by the surgical profession during his stay in Dublin. From there he went to Edinburgh where he was welcomed by Simpson, Syme, Chrisleston and Matthews Duncan, then a pupil of Simpson. On his visit to London he met Spencer Wells, Henry Savage, Routh and others of the Samaritan Hospital. In this institution he operated on a vesicovaginal fistula. The operation although difficult was satisfactorily done, but unfortunately the patient died five or six days later—the first patient Sims had lost after performing the operation hundreds of times. The necropsy showed that the ureters had been closed by the sutures.

Sims arrived in Paris on September 1st. Shortly afterward he met Dr. Huguier, of the Beaujon Hospital, who had a case of vesicovaginal fistula involving the neck of the bladder which had previously been operated upon unsuccessfully. Up to that time no vesicovaginal fistula had been cured in Paris. Sims operated on this woman, Huguier, Nélaton, Denonvilliers and other distinguished surgeons being present. At the end of a week the patient was cured, to the amazement of the spectators, who had believed at the time of

operation that the fistula was incurable. A few days later Sims operated in the service of Dr. Vernier at the St. Louis Hospital on an enormous vesicovaginal fistula. The fundus of the bladder prolapsed through the fistula and protruded externally from the body, inverting the bladder. When the case was cured at the end of a week "it created a regular furore in the Paris hospital circles." Shortly thereafter Sims was invited by Velpeau to operate at La Charité on a young woman, who, it was said, had been operated upon seventeen times, by Joubard de Lamballe, all operations resulting in failure. The size of the fistula had been reduced by the previous operations but was large enough to allow the passage of a finger into the bladder. Although Velpeau had been told that Sims had cured three patients in Paris, he was doubtful about this fistula being closed successfully. At the end of a week the sutures were as Sims had placed them and the woman was cured, her case being the fourth successful one in three or four weeks.

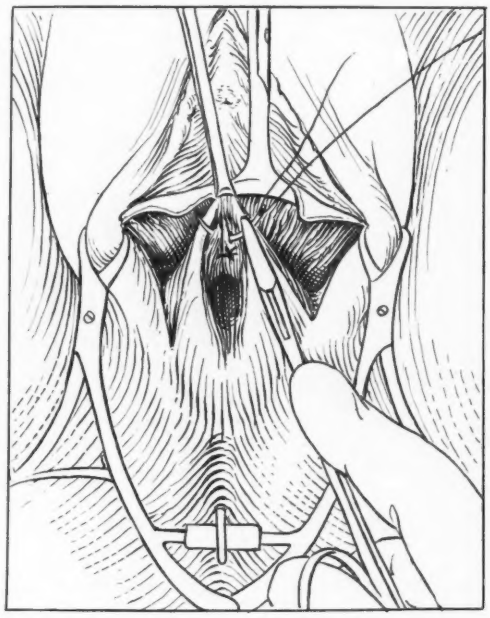

Fig. 13. The anterior rectal wall is picked up by an Allis forceps and put on stretch. The anterior rectal wall is united by interrupted sutures of fine prepared silk, the knots being tied within the bowel lumen.

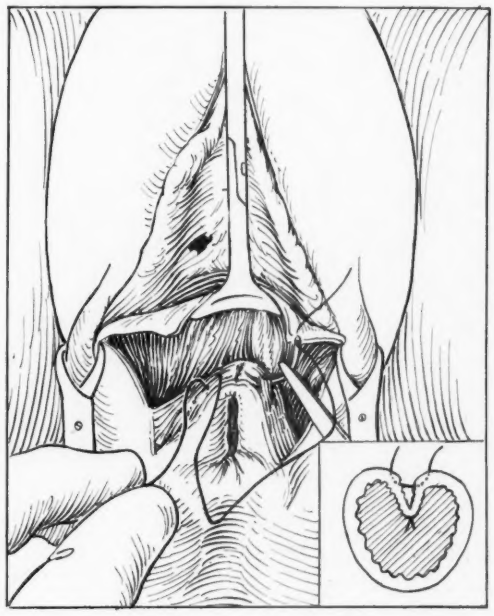

Fig. 14. Reinforcement of rectal closure. The perirectal tissues are approximated over the first suture line by a continuous suture of No. oo chromic catgut. A second row of figure-of-eight sutures of the same material may also be used if the tissues are lax.

Dr. Deroubaix, Surgeon to King Leopold of Belgium, and the leading surgeon in Brussels, came to Paris shortly after the operation in Velpeau's service at La Charité. He had heard about the operation for vesicovaginal fistula performed in Paris and invited Sims to come to Brussels and operate for this lesion in the hospital there. The invitation was accepted and Sims went there a few days later. He did three operations in one morning. Two patients were cured; one died due to the fact that the nurse who was caring for her, inexperienced in the treatment of such conditions, forced the catheter through the posterior wall of the bladder into the peritoneal cavity, an accident that would not have occurred in the hands of a trained person.

During his stay in Brussels, Sims was elected a Corresponding Fellow of the Royal Academy of Medicine, and his name was recommended to the Government for the Legion of Honor. On his return to Paris he operated successfully upon a patient of Dr. Mungenier. The whole base of the bladder was destroyed,

the ureteral orifices could be seen ejecting the urine in spurts, and the bladder was inverted and was seen hanging outside of the body as a hernial mass. Dr. Mungenier stated that he could not get a bed for this patient in any hospital, so Sims arranged to operate upon her in a room in the Hotel Voltaire. There were present at this operation Nélaton, Velpeau, Civiale, Baron Larrey, Sir Joseph Olliffe, Campbell, Huguier and other distinguished physicians of Paris, seventeen or eighteen in number. The operation required about one hour. One week later the twelve sutures used were removed and the patient was cured.

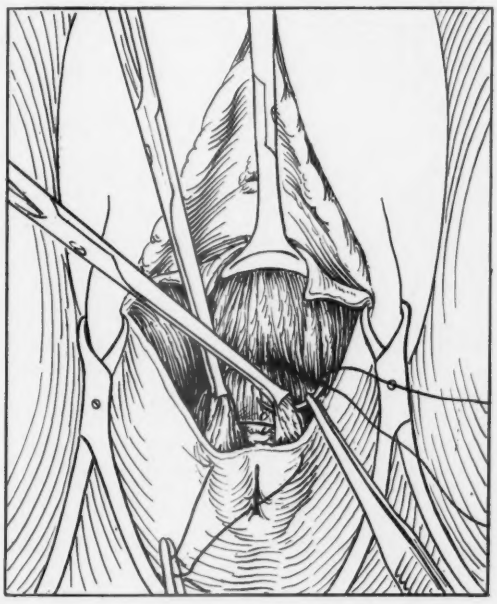

Fig. 15. The ends of the sphincter ani muscle are approximated by two interrupted sutures of No. 0 chromic catgut. A reinforcing suture of prepared silk is passed through the skin on the left, through the ends of the sphincter ani muscle and through the skin on the right. This suture acts as a splint.

Sims had made plans to go to Vienna, but through Dr. Campbell, the great accoucheur of Paris, Nélaton had begged him to remain to see a patient of his from the South of France, her case having been pronounced incurable. On his consent to stay, the woman, who belonged to the higher walks of life, was sent for and arrived in the course of time. She was twenty-one years of age, and the bladder base had been destroyed following the delivery of an hydrocephalic child. She was beautiful, young, rich and accomplished.

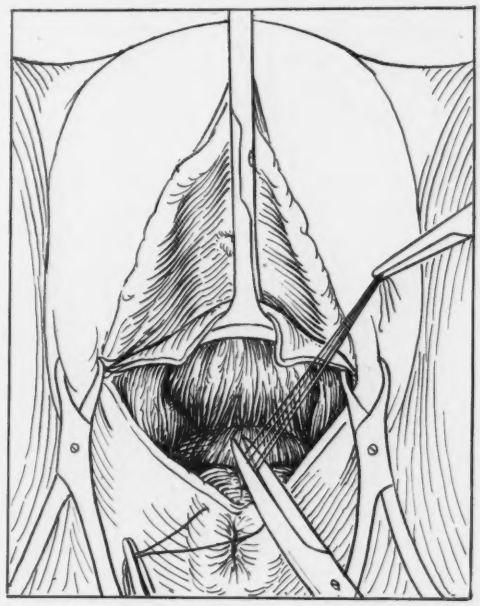

Fig. 16. The sutures in the sphincter ani are tied; the reinforcing suture is held untied.

Her condition was pitiful and she was praying for death in vain. The external parts were so irritated, that the lesions resembled those of confluent small pox. She took large quantities of sedatives and passed sleepless nights and restless days.

Sims having given up his trip to Vienna and having accepted Nélaton's invitation to operate on this patient, she was sent to St. Germain, one hour's distance from Paris, and the operation was performed in the presence of Nélaton, Johnstone, Campbell, Beylard and Herbert. Dr. Campbell, because of his wide experience with chloroform in obstetrics, was chosen to administer the anesthetic. During the operation the respirations ceased three times and artificial respiration was instituted under the direction of Nélaton. Finally, the breathing again became regular and the sutures were tied without anesthesia, when the patient had recovered consciousness. Eight days later Sims removed the sutures in the presence of Dr. Nélaton and the success of the operation was demonstrated.

On January 11, 1862, Sims returned to New York, where he found the country in the throes of a civil war; this made him so unhappy that he decided to take his family to Europe, sailing on July 18, 1862. Through the offices of Sir Joseph Ollife he became the physician of the Duchess of Hamilton. While treating her at Baden Baden during the summer of 1863, he wrote his book, *Clinical Notes on Uterine Surgery*, which he published while residing in London, in 1865. This work was issued simultaneously from the English, German and French presses in London, Berlin and Paris. In his late memoir of Dr. Sims, Dr. Thomas Addis Emmet, of New York, wrote, "Its publication was the turning point of modern gynecology, or, more strictly speaking, American gynecology, of which he may be further termed the father." Reluctantly accepted by the profession at first, this book was instrumental in revolutionizing the specialty of gynecology. Through attending the Duke of Hamilton, who died at the Hotel Bristol in Paris, Sims became the physician of the Empress Eugénie, the wife of Napoleon III. His skill and experience in obstetrics were responsible for his engagement to attend her accouchement and also to attend the Empress of Austria.

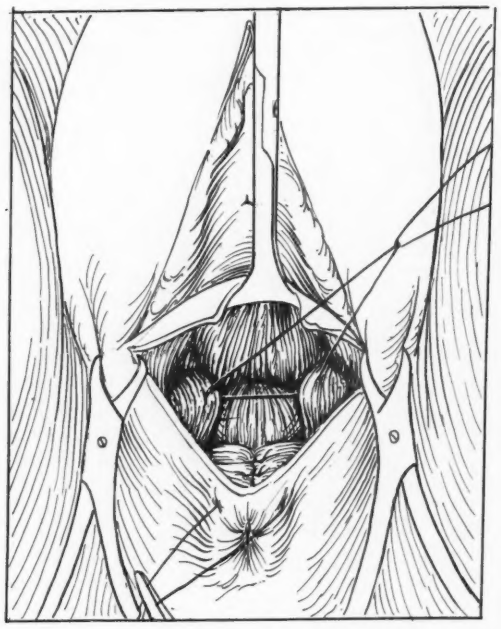

FIG. 17. The levator ani muscles and their fascia are approximated by three interrupted sutures of No. 1 chromic catgut.

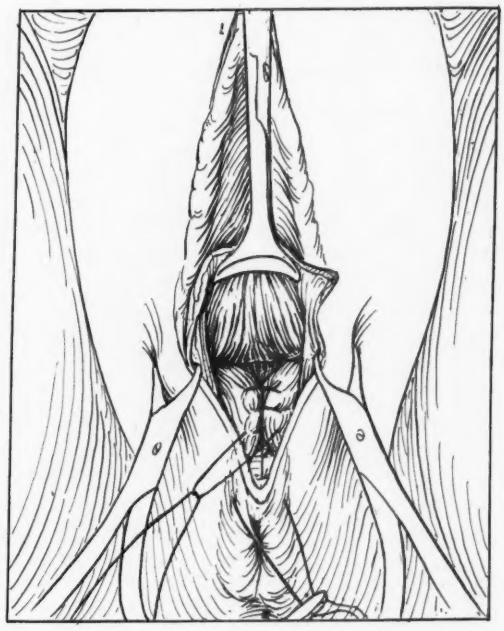

FIG. 18. The levator ani sutures are tied.

One severe blow which came in Sims' life was his resignation from the Woman's Hospital, which he had founded and served well for some fifteen years. This came as the result of a rule promulgated by the governors of the hospital which decreed that only fifteen guests or spectators should be permitted to be present at one operation. Dr. Sims told the governors that if they insisted on enforcing this regulation his resignation was at their disposal. He would not subscribe to this rule, which he thought interfered with the prerogatives of a surgeon, and which he believed accused him of wanting in a proper regard for the feelings and sensibilities of his patients. Unfortunately for the cause of gynecology, his resignation was accepted. The sympathy of the American medical profession in the stand he took was expressed in his unanimous election as president of the American Medical Association in Louisville, Kentucky in 1875. He was a founder of the American Gynecological Society in

1876, and its president in 1880. In 1881, Jefferson University conferred upon him the degree of Doctor of Laws. A fine marble bust of J. Marion Sims stands at Jefferson Medical College, while another marble bust cut by Dubois, of Paris, was erected at the Woman's Hospital of the State of New York. Sims was decorated by the governments of France, Italy, Germany, Spain, Portugal and Belgium. He died at his residence, 267 Madison Avenue, New York, November 13, 1883, at 3:15 A.M. at the age of seventy.

Shortly after his death a movement was started in Europe and the United States for the erection of a statue to preserve his memory. As stated by George Gray Ward, "This was a spontaneous gift from his brothers in the profession throughout the civilized world and from many of the unfortunate beings his genius and skill had benefited. South Carolina, his native state, has erected a beautiful memorial to him in Columbia."

The statue was originally erected in Bryant Park, New York. Later, when the park was repaired the statue was removed and for the time being was lost. It was finally located under the anchorage of the Brooklyn Bridge. After its rescue a new pedestal was designed for it and it now stands on Fifth Avenue at 103rd Street, directly across from the New York Academy of Medicine. The inscription on the first pedestal in Bryant Park summarized the life and inspiring career of the "Father of Gynecology." It read as follows:

J. Marion Sims, M.D. L.L.D.
Born in South Carolina, 1813,
died in New York City in 1883.
Surgeon and Philanthropist
Founder of the Woman's Hospital
of the State of New York
His brilliant achievements carried the fame of American Surgery throughout the civilized world.
In recognition of his services in the cause of science and mankind
He received the highest honors in the gift of his Countrymen
And decorations from the Governments of France, Portugal, Spain, Belgium and Italy.

On the reverse was inscribed:

Presented to the City of New York
By
His professional friends, loving patients
And
Many Admirers
Throughout the world.

Sims' professional fame rests on four foundation stones: (1) his operation for vesicovaginal fistula with silver wire sutures, a lesion estimated as incurable before his operation; (2) the invention of the Sims speculum; (3) his exposition of the pathology and true method of cure of trismus nascentium, or lockjaw of infants; and (4) his many valuable contributions to medical literature.

In the days of J. Marion Sims all the vesicovaginal fistulas were the result of the trauma of labor. Women with contracted pelves were left in labor for a number of days, frequently with filled bladders, so that with each contraction of the uterus the bladder was firmly pressed against the symphysis pubis by the advancing and retracting presenting part. It is not to be wondered at that eventually a slough formed, resulting in the enormous fistulas which Sims described, some of them involving the whole base of the bladder. Yet, in those days there was little else that could be done at delivery. Cesarean section was almost universally fatal and was not even considered in a woman with a moderate contraction of the pelvis; and it was well that it was so, for a woman with a vesicovaginal fistula, despite her suffering, could survive, and after Sims' success in closing these fistulas in 1849, could again become a useful member of society. Most of these women in a state of exhaustion and infection after prolonged labors were delivered by forceps, and the fistulas were frequently ascribed

to the use of these instruments rather than to the sloughing of the parts from pressure necrosis. In reality, it was the withholding of the forceps rather than their use that was responsible for this infirmity. Bad as they were, these obstetrical fistulas had one point in their favor—they were easily located; they were usually in the median line and could be exposed for suturing after the invention of the proper instruments.

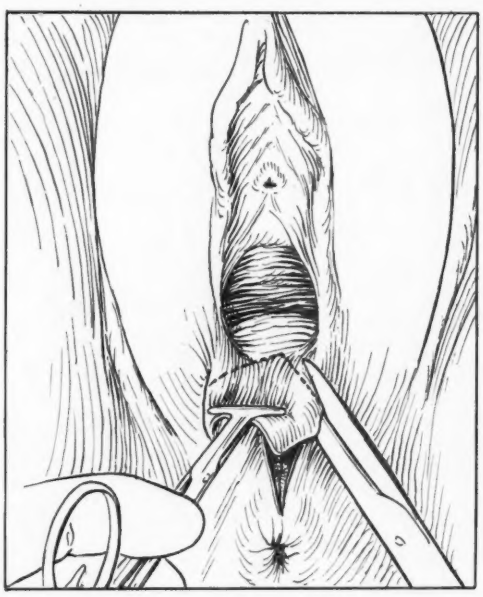

Fig. 19. The redundant posterior vaginal wall is resected. Care should be exercised that not too much posterior vaginal wall be resected, so that approximation without tension may result.

With the advent of asepsis and the improvement of obstetrics in general and especially of delivery care, large obstetrical fistulas are seldom encountered nowadays. In some cases the bladder may be ground against the pubic ramus of one side or the other by the forceps, resulting in a vesicovaginal fistula adherent to bone, a type of fistula extremely difficult to cure. I speak from experience when I say this, as I had to operate upon a young woman six times before achieving success. Because of the marked strides made in gynecological surgery during the last half century, operations on the female pelvic organs are performed daily in practically all hospitals. As a result of this tremendous amount of operating, the female urinary bladder, which is attached anteriorly to the uterus, is necessarily exposed to injury. There has, therefore, developed in more recent times a type of vesicovaginal fistula that may be termed a surgical fistula, in contradistinction to the obstetrical fistula. Surgical obstetric methods, such as the vaginal cesarean section, may account for a few of these disorders. Surgical vesicovaginal fistulas may be the result of certain operative procedures such as panhysterectomy, abdominal and vaginal. Operations for the cure of cystocele and uterine prolapse, such as vaginal fixation of the uterus, the interposition operation, also known as the Watkins-Schauta-Wertheim operation, the Manchester operation and less extensive interventions on the anterior vaginal wall and bladder, may also be responsible for a number of these disorders.

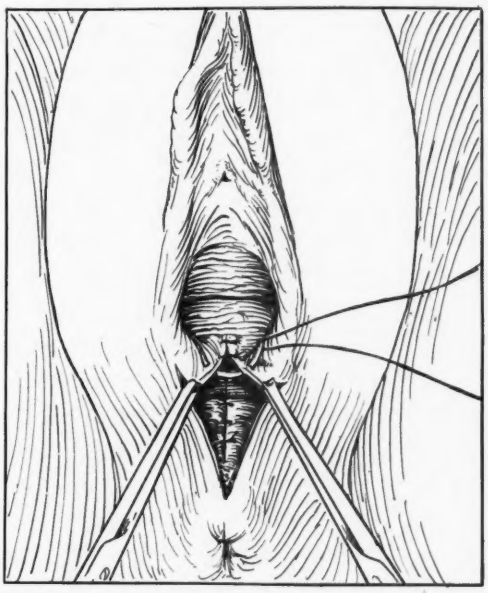

Fig. 20. The vagina is closed by interrupted sutures of No. 1 chromic catgut.

Surgical fistulas result in three ways: first, by direct trauma to the bladder during operation; second, by sloughing on account of interference with the blood supply of a certain area of the bladder consequent to the operation; and third, by inclusion of the bladder wall in the suture or sutures used to close the vagina in a panhysterectomy. The last usually means

that the bladder has not been well mobilized and retracted. While it is true that direct trauma and inclusion of the bladder wall in the sutures of a hysterectomy are extremely rare in the hands of the experienced, a small slough resulting from the wide separation of the bladder in performing certain radical pelvic operations may occur even in the hands of the most experienced. When due to operative trauma, the fistula appears soon thereafter; when due to necrosis and sloughing, a number of days elapse before urinary incontinence is apparent. Syphilis, tuberculosis and carcinoma, by erosion and ulceration, may be responsible for a bladder fistula, while the constant pressure of foreign bodies, the commonest of which is the pessary, is the etiologic factor in rare cases.

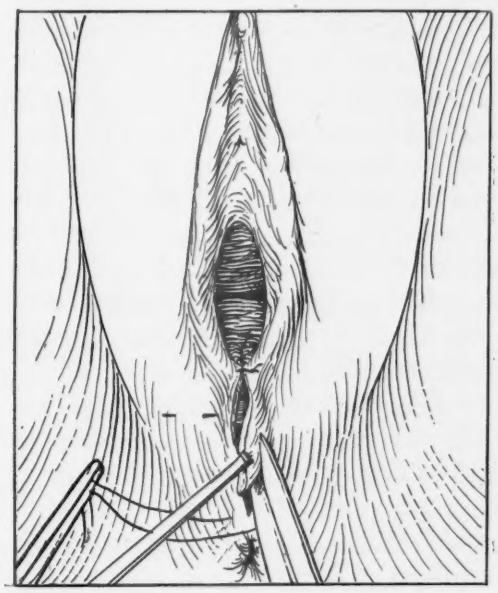

Fig. 21. The superficial perineal tissues have been approximated by a continuous suture of No. oo chromic catgut.

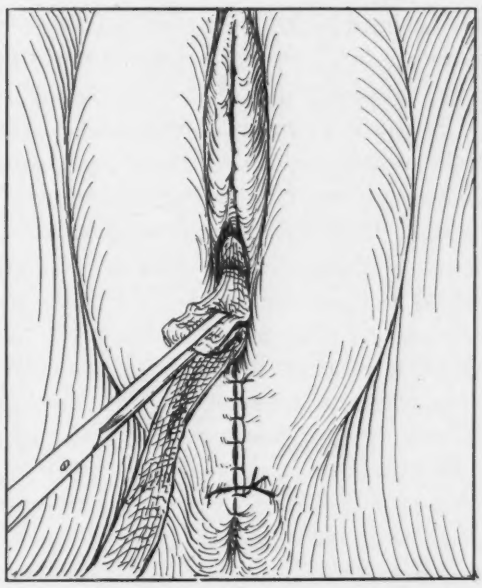

Fig. 22. The skin is closed by a continuous suture of No. oo chromic catgut. The reinforcing suture is loosely tied. A loose iodoform gauze pack is placed in the vagina and left *in situ* for twenty-four hours.

Three types of fistulas offer great difficulties: those which, as previously mentioned, are adherent to bone; those which are situated high in a scarred vaginal vault, and those in which there is extensive loss of tissue.

Regardless of the difficulties encountered in operating upon surgical vesicovaginal fistulas, most of them are closed through the vaginal route, whereas special methods, intravesical and intraperitoneal, have been devised for those that cannot be reached through the vagina. The Schuchardt incision, by the excellent exposure that it gives to the vaginal vault, high though it may be, has in my hands proved itself valuable in reaching fistulas that could not have been made accessible without it.

PREOPERATIVE PREPARATION

The preoperative preparation of these patients is all important. A number arrive in the hospital with phosphatic deposits on the vulva, in the vagina and on the inner aspect of the thighs. The formation of granulation tissue and ulceration are sequelae of this irritation. These areas are denuded of surface epithelium and bleed readily on friction. It is to these lesions that Sims referred when he stated that they had the appearance of confluent small pox. The parts must be brought back to a healthy state before operating, otherwise the sutures will not hold and recurrence will be the case. To obtain this desideratum the fol-

lowing régime may be employed: The urine must be acidified to prevent the further formation of phosphatic deposits. According to George Gray Ward, Thomas Addis Emmet recommended for this purpose 1 dram benzoic acid and 2 drams of sodium borate in 8 ounces of water. He gave this mixture in water, one tablespoonful three times a day for four days and one teaspoonful three times a day thereafter. Ammonium chloride and acid sodium phosphate seem to be the drugs in vogue at the present time to accomplish this purpose. Fluids are administered in large amounts. An indwelling catheter is introduced into the bladder in the hope of directing some of the urinary stream away from the inflamed parts. The urinary deposits are removed by means of warm, mildly acid irrigations, such as 1:1000 solution of acetic, hydrochloric or nitric acid. The irritated surfaces are then painted with a 10 per cent solution of silver nitrate, and the parts are protected by the free application of a bland ointment such as diachylon ointment, which I prefer, and others. With this program carefully followed it takes an average of two to three weeks to get the parts in satisfactory condition for operation.

SUTURE MATERIAL

Marion Sims closed his first vesicovaginal fistula by means of silver-wire sutures, because, in his own words, silver wire caused no inflammation and tumefaction in the tissues. He had succeeded with silver wire after having failed with all the suture material that he had employed heretofore. But silver wire has certain disadvantages: it has low tensile strength, it cannot be tied, it must be fixed by twisting, and it may produce a disfiguring argyria. In recent times a new noble metal, rustless alloy steel wire, has come into use. Originally proposed by W. Wayne Babcock, of Philadelphia, in the suturing of septic wounds, and recommended by him in the suture of vesicovaginal fistulas, this alloy wire has all the advantages of silver wire and none of the inconveniences. It is soft, strong and nonirritating and does not discolor the tissues. Because of its strength a very fine-gauge suture may be used and a strong knot may readily be tied. On the recommendation of Dr. Babcock, I have substituted it for silver wire, with great satisfaction, in the management of vesicovaginal fistula. The use of catgut in human tissues causes swelling and exudation of serum and leucocytes, which in three or four days result in the formation of an adjacent necrosis, and by the end of a week in a distinct greenish layer around the catgut, thereby delaying healing until the irritating foreign body and necrotic tissues are removed or replaced. The foregoing shows why fistulas closed with catgut recurred and were subsequently successfully closed by means of metallic sutures. A method that has proved successful in my hands consists of closing the bladder opening with very fine catgut sutures, skipping the bladder mucosa, and closing the vagina with steel alloy or silver wire sutures. It is important not to resect the edges of the anterior vaginal wall before approximating them, so that in the case of a recurrence there will still be left enough anterior vaginal wall with which to work.

Many surgeons have given up metallic sutures entirely, depending exclusively on catgut, and report satisfactory results. My own experience in closing fistulas with metallic sutures, when there have been a number of failures through the use of catgut by other surgeons, has impressed me with the reliability of the metallic suture, which today is not likely to cause inflammation and tumefaction in the tissues any more than it did in 1849 when Sims closed the first vesicovaginal fistula.

TECHNIC OF OPERATION

Because of the complexity of vesicovaginal fistulas numerous methods of closure have had to be devised. These may be summarized as follows:

1. The vaginal procedure, including several varieties of technic.

A. Paring the edges and closing in one layer with silver wire or alloy wire sutures.
B. Circumcising the fistulous opening, turning the cuff into the bladder, closing the fistula by approximating the bladder musculature over the cuff without penetrating the bladder mucosa, and closing the vaginal wall separately. The vaginal wall is satisfactorily closed by means of metallic sutures placed perpendicularly to the line of bladder suture, thus staggering the suture lines.
C. Mobilization of the bladder and closure of the bladder and vagina in separate layers.
D. Using the cervix and body of the uterus to close the opening.
E. Suturing pedicled flaps from the vagina and vulva to bridge over the defect.
F. Using the gracilis muscle as a pedicle flap (Garlock technic).
G. Colpocleisis.

2. The intravesical procedure through a suprapubic incision, best illustrated by the method of Hugh H. Young.
3. The suprapubic extraperitoneal procedure through a Pfannenstiel incision.
4. The intraperitoneal procedure through an abdominal incision (Legueu technic). This is especially useful in high fistulas following panhysterectomy, where they are inaccessible vaginally.
5. Implantation of the ureters in the sigmoid (Coffey technic), and its modifications.

SUPRAPUBIC BLADDER DRAINAGE

Suprapubic drainage of the bladder is an operation used daily on practically every urological service. Yet a review of the chapter on vesicovaginal fistula in most of the important textbooks of gynecology fails to show any mention of this method of bladder drainage in connection with operations for vesicovaginal fistula, except those done by the intravesical route. When used in association with the vaginal method of repair of the bladder defects, it may render great service. I have used it during the last few years on six difficult cases and have been rewarded by its employment. In three cases it was resorted to some time before attempting the closure in order to divert the urinary stream and to get the parts in satisfactory condition for operation. In the other three cases it was used after closure of the fistula. The details of these latter cases are briefly given. The first was a urethrovaginal fistula that had failed to heal after a first operation. At the second intervention suprapubic drainage was instituted and no urine was allowed to come through the urethra for twenty-one days. The suprapubic tube was then clamped and the patient voided normally. The suprapubic incision healed rapidly after removing the catheter. The other two patients presented extremely difficult vesicovaginal fistulas, both operated upon before, one several times without success. With the aid of the Schuchardt incision both these fistulas were closed by the vaginal approach. Suprapubic drainage as described above was instituted, and both fistulas were firmly healed when the patients were allowed to void at the end of the twenty-first day. I am convinced that the more frequent use of this method of drainage would lead to happy results in the treatment of difficult fistulas.

POSTOPERATIVE CARE

The postoperative care is of great importance and should be carried out by the operator himself, and not left to less experienced young assistants. Except in the case of transplantation of the ureters into the sigmoid, constant bladder drainage should be instituted. This may be accomplished by introducing a catheter into the bladder through the urethra, a plain soft-rubber catheter, the wing-tip catheter and the Foley catheter all being satisfactory and employed in preference to the Pezzer catheter because of its bulbous tip. In the difficult and complicated cases, as mentioned above, suprapubic

drainage is my preference. The urethral catheter is left *in situ* for ten days; the suprapubic catheter for twenty-one days. Irrigation of the bladder with warm boric acid solution should be carried out as indicated, but no strong antiseptics should be left in the bladder. Sulfadiazine, or methenamene and acid sodium phosphate is used as a urinary antiseptic while constant drainage is maintained. Keeping the patient on her abdomen during part or all of the convalescence is of value where bladder drainage has been instituted through the urethra.

When metallic sutures are used they are removed at the end of a month, always under anesthesia; intravenous anesthesia is quite satisfactory, but general anesthesia may be used if preferred. The patient is allowed out of bed the day after the constant drainage apparatus is removed, on the eleventh or the twenty-second day, depending upon the type of drainage used; she returns to the hospital at the end of a month to have the metallic sutures removed, and may return home the same day or the day following.

STATISTICS

Twenty-six women with vesicovaginal fistulas, nine obstetrical and seventeen surgical, came under my care. There were twenty-five attempted vaginal closures, with twenty-one successes, twenty of the latter being my own and one that of another surgeon after I had failed at a previous vaginal operation. Five patients required additional procedures that were varied in their extent. In this group of patients colpocleisis was successfully carried out in two cases. Intravesical closure was resorted to in four cases, all resulting in failures. The ureters were transplanted into the sigmoid in two cases and ureterovesical anastomosis was practiced in one, the last three operations mentioned having been performed by Dr. Rogers C. Graves, urologist-in-chief at the Carney Hospital. In one case a hemicystectomy was done for tuberculosis of the bladder. There were six suprapubic cystostomies, three before closure of the fistula and three after it. The Schuchardt incision, for exposure, was employed in eight cases.

MANAGEMENT OF RECTOVAGINAL FISTULAS AND OF COMPLETE TEARS OF THE PERINEUM

Rectovaginal fistula, an opening between the rectum and vagina, may occur independently of complete tear of the perineum or tears involving the sphincter of the anus and the anterior rectal wall. These constitute the group of smaller fistulas resulting from the direct trauma of labor or from later sloughing due to bruising of the parts and interference with their blood supply during labor. The slough occurs a few days after delivery and may heal spontaneously. When such is not the case, the fistulous tract is dissected out, turned into the rectum, the vaginal side is closed with fine catgut sutures, and the fistulous tract may be later excised through the rectum or removed by the cautery when healing has taken place.

The large and more commonly met rectovaginal fistulas are usually the result of imperfect healing after the repair of a laceration of the perineum, involving the anal sphincter and the anterior rectal wall. All varieties of fistula may be found, depending upon the type of imperfect healing that has taken place. The simplest way of handling this condition, in my experience, consists of incising the perineum in the median line, above and below the fistula, thus reduplicating the original complete tear through the sphincter ani and the rectovaginal septum, and proceeding again with the repair of a complete laceration. Because of the close association of the fistulas with the lacerations of the perineum involving the sphincter ani and the anterior wall of the rectum, the operative care of these lesions will be stressed in this article.

Lacerations of the pelvic floor may be incomplete, when they do not involve the

sphincter of the anus or complete, when they extend through the sphincter and frequently through the anterior rectal wall. Rarely are they the result of external trauma; commonly they are consecutive to the injuries of childbirth. They may occur in children as well as in adults. I[17] have operated upon three female children, aged eight, seven and seven years, respectively, for lacerations through the sphincter ani in two cases, and extending to the side of and exposing the sphincter in 1. These were due to being impaled on an iron picket fence in one case, to rape in another, and to being cut by an automobile fender in still another. The injuries in adults are usually the result of the trauma of labor and, despite the improvement of obstetric practice, they are still frequently encountered.

Thomas Addis Emmet,[13] in his original article in 1883, divided injuries of the pelvic floor into two main groups: median-line lacerations of the perineum, the importance of which is directly related to the amount of injury to the function of the anal sphincter muscle; and injuries to the pelvic fascia and the levator ani muscle —the sulcus tears—which result in the crippling of an important function of the posterior vaginal segment, namely, the ability to close the vaginal orifice. In this paper we are concerned with the first group, the median-line lacerations involving the sphincter ani and frequently the anterior rectal wall. The principle in repair of such injuries is well stated by George Gray Ward:[15] "In this type the nature of the injury is apparent and the principle of its cure is simple, although its attainment is difficult owing to the septic field. The sphincter ani muscle may be compared to the letter O. The median-line tear of the perineal body becomes serious as it invades this muscle and impairs its integrity. When torn completely through, the torn ends of the muscle spring apart and it is converted into a letter U and a loss of control of feces and flatus results. The principle of cure is obviously to unite the separated ends of the muscle, reconverting the U into the original O, thus restoring its function."

There are two general methods advocated in the repair of complete tears of the perineum and their accompanying rectovaginal fistulas: the apron or flap method, and the layer-suture method with or without rectal sutures. The former was advocated by J. Collins Warren,[11,12] of Boston, in 1878, and presented before the American Gynecological Society in 1882. This mode of operating was accepted and elaborated upon by Kelly, Ristine, Ward, Farrar, Norman Miller, Ralph E. Campbell and many others. From the start I have employed the layer-suture method with rectal sutures, and since my results have been satisfactory, I have not had occasion to change. Some operators, as Royston,[14] favor continuous sutures, whereas my[16] preference is given to interrupted sutures except in the skin, where I use a running stitch of very fine chromic catgut. The only exception to this rule is in the rare instance when, because of scarring, there is tension on the skin, when I resort to interrupted sutures of fine chromic catgut or fine prepared silk.

PROPHYLAXIS

The literature of the last quarter of a century frequently calls attention to the prevention of complete lacerations of the perineum; obviously this distressing complication of childbirth may be avoided, in most instances, by using certain measures during delivery. Two types of preventive measures are advocated to forestall this accident: first, incisions of the perineum; and second, manual dilatation of the perineum and the vagina. Two types of incisions are recommended: the median incision known as perineotomy and the lateral or mediolateral incision, known as episiotomy. The advantages of the median incision are that it is easier to repair and that it leaves a more elastic perineum. Its main disadvantage is that if it extends during delivery the sphincter ani may be

injured. This, however, may be easily overcome by encircling the anus on one side or the other, so that the sphincter retracts toward the opposite side. As a rule the lateral incision is employed when considerable room is required and the median incision when the opposite is true. The lateral incision is practiced on the side toward which the occiput points, or, to put it another way, a right episiotomy in a right position and a left episiotomy in a left position. Under unusual circumstances it may be necessary to incise the two sides.

Whereas perineal incisions are usually employed in primiparae, they sometimes become indicated in multiparae. A multipara who was subjected to an episiotomy or an extensive pelvic floor repair with her first accouchement appears at a second delivery with external genitals resembling those of a primipara, and in addition has a scar caused by the union of the severed tissues, again necessitating an incision at the present childbirth. This principle also applies to a multipara who has been subjected to an extensive perineal repair previous to the delivery in question.

PERINEAL INCISIONS VERSUS MANUAL DILATATION OF THE PERINEUM

Those who advocate manual dilatation of the perineum and vagina before delivery believe that this procedure makes perineal incisions unnecessary. Doubtless this maneuver will overcome the resistance of the perineum, but it frequently is responsible for the separation of the levator ani muscles under the intact mucous membrane and skin. Because of the separation of the levator ani muscles, a rectocele soon appears; this disorder is practically never observed after well reconstructed perineal incisions.

A rectocele in connection with complete lacerations of the perineum is seldom observed. This tends to prove that it is not the tearing of the perineum that is responsible for the defect, but rather the stretching and relaxation of the fascial structures of the posterior vaginal segment.

IMMEDIATE VERSUS LATE REPAIR

It is advisable to repair this type of laceration immediately after the third stage of labor when the patient is seen at delivery or immediately thereafter. As a rule the puerperium is not prolonged or complicated by this intervention. If, however, the parturient is not seen soon after delivery, at least three months are allowed to elapse before operating. At this time involution has taken place, the edema has subsided, scar tissue has formed between the torn edges, and a more satisfactory repair can be carried out than when operation is attempted a few days after labor.

PREOPERATIVE PREPARATION

The preoperative preparation consists of thorough catharsis, by means of castor oil, prescribed four days and two days before operation. A saline, cleansing enema is given the afternoon before but none the morning of operation, and for the two preceding days a low-residue diet is advised. The preparation of the operative field is carried out under anesthesia and consists of gently scrubbing the external genitals and the vagina with tincture of green soap and warm sterile water, using gauze at the end of a sponge forceps. This is followed by irrigation with a 1:1000 solution of potassium mercuric iodide after which the parts are dried and painted with tincture of zephiran. The sterile drapings are then applied and the patient is ready for operation.

TECHNIC OF OPERATION

The pelvic floor is opened by an H-shaped incision. The lateral incision on each side extends from a point below the duct of the vulvovaginal gland to the retracted end of the sphincter muscle. The transverse incision joins the two lateral ones by running through the scarred rectovaginal septum. A flap of the posterior vaginal wall is dissected upward, exposing the rectum, which is separated from the levator ani muscles by blunt dissection. A second pair of sterile gloves is put on and the rectum and torn

sphincter are dilated, after which the extra gloves are discarded. The anterior rectal wall is picked up by an Allis forceps at the upper angle of the tear and put on stretch, the scar tissue is trimmed from the edges, and the torn edges are united by interrupted sutures of fine prepared silk (Kaldermic), the knots being tied within the bowel lumen. The perirectal tissues are approximated over the first suture line by a continuous stitch of No. 00 chromic catgut, avoiding constriction of the tissues. If the perirectal tissues are lax, they are further approximated by a series of figure-of-eight sutures of No. 00 chromic catgut. This layer is omitted if the tissues are moderately tense. The torn ends of the sphincter muscle are dissected out of their bed of scar tissue and approximated with two interrupted sutures of No. 0 chromic catgut tied so as not to constrict this structure. A reinforcing suture of prepared silk (Kaldermic) is introduced by passing it through the skin on the left side, the united ends of the sphincter ani and the skin on the right side, and is tied at the completion of the operation. The levator ani muscles and their fascia are approximated by three interrupted sutures of No. 1 chromic catgut, the excess of the posterior vaginal wall is resected, and the edges of the vaginal incision are united with No. 1 chromic catgut interruptedly. The triangular ligament is approximated by a running stitch of No. 00 tanned catgut. The skin may be closed in one of three ways: by a continuous or subcuticular stitch of No. 00 tanned catgut; by interrupted sutures of No. 00 tanned catgut, which in their course pick up the deeper tissues to obliterate dead space; and, if there have been previous attempts at repair and if considerable scar tissue is present, by interrupted fine prepared silk sutures. The splinting silk stitch in the sphincter ani is loosely tied. The vagina is loosely packed with iodoform gauze, which is removed at the end of twenty-four hours. Emphasis must be placed on fine suture material and approximation without tension. As my experience with this operation has increased, I have used finer and finer suture material.*

POSTOPERATIVE CARE

Morphine sulphate and deoderized tincture of opium are prescribed as necessary. For the first six days the diet consists of hot and cold fluids without residue, such as beef tea, strained soup, bouillon, the white of an egg with two ounces of strained orange juice and water to make four ounces, tea with lemon and black coffee. Milk is not allowed. The external suture line is painted with aqueous solution of zephiran after micturition or catheterization. After forty-eight hours a warm douche consisting of a teaspoonful (4.0 Gm.) of compound zinc sulfate powder, National Formulary, VIIth revision, dissolved in a quart (1,000 cc.) of warm water, is given daily, using a soft rubber catheter as a tip. On the morning of the seventh postoperative day the patient is given a seidlitz powder. One-half hour later six ounces of warm sweet oil is instilled into the rectum and retained. The patient is given a low soap-suds or saline enema when the desire to empty the bowels becomes apparent and is instructed not to strain. Following this a soft diet is allowed and by the ninth day a full diet. The silk sutures, if employed, are removed on the ninth day; the patient is allowed out of bed on the twelfth day and usually discharged on the fourteenth or fifteenth postoperative day, to be re-examined four weeks later.

TABLE 1

COMPLETE LACERATION OF THE PERINEUM AND RECTOVAGINAL FISTULA

Summary of Cases

Fresh complete laceration of the perineum	9
Old complete laceration of the perineum	40
Complete laceration of the perineum with involvement of anterior rectal wall	41
Complete laceration of the perineum with involvement of anterior and posterior rectal walls	1
Complete laceration of the perineum with rectovaginal fistula	10
Rectovaginal fistula	9
Total	110

* The illustrations of this operation were made by the artist of *Modern Medicine* from a film produced by Davis & Geck, entitled—"Complete laceration of the perineum" by L. E. Phaneuf.

TABLE II

COMPLETE LACERATION OF THE PERINEUM AND RECTOVAGINAL FISTULA

Etiology

Complete laceration, child 7 years of age, impaled on an iron picket fence	1
Complete laceration, child 7 years of age, following rape	1
Rectovaginal fistula following a perineotomy for vaginismus	1
Rectovaginal fistula following an operation for fistula in ano	1
Rectovaginal fistula following a perineorrhaphy	1
Complete laceration and rectovaginal fistula resulting from the trauma of labor	105
Total	110

TABLE III

PREVIOUS UNSUCCESSFUL REPAIRS

Secondary

One previous unsuccessful repair	10
Two previous unsuccessful repairs	3
Three previous unsuccessful repairs	1
Total	14

TABLE IV

ADDITIONAL LESIONS IN THE GROUP OF 101 PATIENTS WITH OLD COMPLETE LACERATION OF THE PERINEUM AND RECTOVAGINAL FISTULA

Laceration of right labium minus	1
Prolapse of rectum	5
Rectal polyp	1
External thrombotic hemorrhoid	1
Rectocele	4
Cystocele	17
Vesicovaginal fistula	2
Relaxed vesical sphincter	2
Laceration of cervix	33
Erosion of cervix	8
Stenosis of cervix	1
Infravaginal hypertrophy of cervix	1
Prolapse of cervical stump	1
Cervical polyp	2
Hypertrophied cervix	2
Myoma uteri	1
Myometrial hypertrophy	1
Third degree prolapse of uterus	3
Second degree prolapse of uterus	3
Descensus uteri	2
Third degree retroversion	1
Second degree retroversion	2

Note. Two laparotomies for suspension of the uterus, and in connection with one of them shortening of the uterosacral ligaments, were performed two weeks after the plastic repair. The Moschcowitz operation for prolapse of the rectum and fundic hysterectomy were done two weeks before the reconstruction of the complete tear of the perineum.

One hundred eighteen additional operations were performed in this group of 101 patients with old complete lacerations of the perineum and rectovaginal fistula, as depicted in Table v. Three laparotomies were performed. In one patient the uterus was suspended, in a second patient the uterosacral ligaments were shortened and the uterus was suspended, and in a third patient the Moschcowitz operation for prolapse of the rectum and a fundic hysterectomy were resorted to two weeks before the reconstruction of the complete tear of the perineum. For obvious reasons an abdominal operation should not be performed in conjunction with the reconstruction of a perineum lacerated in the third degree. Table II summarizes the etiology of the 110 cases.

TABLE V

ADDITIONAL OPERATIONS IN THE GROUP OF 101 PATIENTS WITH OLD COMPLETE LACERATION OF THE PERINEUM AND RECTOVAGINAL FISTULA

Repair of right labium minus	1
Moschcowitz operation for prolapse of rectum, fundic hysterectomy, bilateral salpingo-oöphorectomy, bladder advancement, abdominal fixation of uterus	1
Excision of rectal polyp	1
Evacuation of clot from external thrombotic hemorrhoid	1
Kelly operation for relaxed vesical sphincter	1
Kennedy operation for relaxed vesical sphincter	1
Closure of vesicovaginal fistula	2
Resection of suburethral fold	1
Operation for cystocele	10
Dilatation and curettage	38
Cauterization of cervix	4
Conization of cervix	1
Cervical polypectomy	2
Right trachelorrhaphy	2
Bilateral trachelorrhaphy	23
Shroeder amputation of cervix	2
Amputation of cervix	11
Vaginal trachelectomy for prolapse of cervical stump	1
Interposition operation	7
Vaginal hysterectomy	4
Manchester operation	1
Round ligament suspension of uterus	2
Shortening of uterosacral ligaments	1
Total additional operations	118

The case of the first child, seven years of age, who had a complete laceration of the perineum with involvement of the rectovaginal septum as the result of having been impaled on an iron picket fence, is interesting from two standpoints. If in a child of that age reconstruction of the parts is not carried out soon after the accident, and scar tissue is allowed to form, it becomes increasingly difficult to secure a satisfactory repair. If a successful repair is not attained, there is imperfect development of the lower rectum, anus and external

genitals. In this particular case it was necessary to obtain needles small enough to work with from the eye department of the hospital. Healing took place by first intention and a satisfactory anus, perineum and vagina were secured. The patient was seen for some time after operation but then disappeared. Eleven years later, when she was eighteen years old, she reported to the clinic complaining of dysmenorrhea. Examination then showed perfectly developed external genitals and anus. An examination made fifteen years after operation, when she was twenty-two years old, again confirmed these findings, and in both instances the scar in the perineum could not be identified. One hundred five of the cases followed the trauma of childbirth, the usual etiologic factor. Complete laceration of the perineum and rectovaginal fistula is frequently complicated by other lesions.

Table IV shows that in the 101 patients who had old lacerations and fistulas there were ninety-four additional lesions.

Table VI

COMPLETE LACERATION OF THE PERINEUM AND RECTOVAGINAL FISTULA

Postoperative Complications

Rectovaginal fistula	6
Ischiorectal abscess with rectovaginal fistula	2
Ischiorectal abscess with perineal sinus	1
Slight separation of sphincter ends	1
Small area of skin slough above sphincter ani	1
Skin separation above sphincter ani	3
Hypertrophied tabs of rectal mucosa	1
Complete separation of rectum, sphincter ani and perineal muscles from lack of healing	1

Sixteen patients had postoperative complications. They were treated as follows:

Case 1. Small rectovaginal fistula, repaired ten months later, satisfactory end result.

Case 2. Small rectovaginal fistula, repaired five months later, satisfactory end result.

Case 3. Small area of skin slough above sphincter ani. Satisfactory healing by second intention.

Case 4. Small rectovaginal fistula, repaired seven months later, satisfactory end result.

Case 5. Ischiorectal abscess with perineal sinus, right. Incision and drainage four months after original operation; healing satisfactory.

Case 6. Slight separation of sphincter ends, healing by scar tissue; good bowel control.

Case 7. Small high rectovaginal fistula. This patient had been operated upon for a large rectovaginal fistula which had followed a perineotomy for vaginismus. She was lost sight of.

Case 8. Seventy years of age. Convalescence complicated by bronchopneumonia and coronary disease. Discharged from the hospital with a small rectovaginal fistula. She has refused to report for examination.

Case 9. Perineal sinus, healed by second intention; satisfactory end result.

Case 10. Ischiorectal abscess with fistula two months after operation. Excision of fistula, healing by second intention; satisfactory end result.

Case 11. Hypertrophied tabs of rectal mucosa developing after operation. Injection of tabs with sclerosing solution; satisfactory result.

Case 12. Small ischiorectal abscess and fistula, left, seven months after operation. Spontaneous drainage, healing by second intention; satisfactory end result.

Case 13. Infection of skin around anus, healing by second intention; satisfactory end result.

Case 14. Small rectovaginal fistula operated upon twice; small recurrence each time; healed spontaneously; satisfactory end result.

Case 15. Slight separation of skin above anus; healing by second intention; satisfactory end result.

Case 16. Complete separation of rectum, sphincter ani and perineal muscles due to poor healing of tissues; no infection. One month previously she had had a successful repair of a large vesicovaginal fistula consecutive to an abdominal panhysterectomy. She was a thin, asthenic woman in poor physical condition. Ten days after first operation a second repair was done using Alloy wire sutures. Large doses of vitamin C were prescribed; good healing. Check-up one year later showed a good sphincter and perineum and perfect bowel control.

TABLE VII

COMPLETE LACERATION OF THE PERINEUM AND RECTOVAGINAL FISTULA

End Results

One hundred ten patients were operated upon, nine for fresh lacerations and one hundred one for old lacerations or rectovaginal fistulas.

The criteria of a satisfactory result are five in number; namely: a healed rectum, a healed rectovaginal fistula when present, a reconstructed anal sphincter, bowel control and a firm but elastic perineal body.

The nine patients operated upon for fresh lacerations had firm healing, without complications, and a satisfactory end result was obtained.

The one hundred one patients operated upon for old complete lacerations or rectovaginal fistulas had sixteen postoperative complications:

8 patients who had postoperative complications had additional operative procedures, and satisfactory end results were secured.

8 patients who had postoperative complications had healing by second intention, as explained in Table VI, and satisfactory end results were secured.

The final result in one hundred eight of one hundred ten patients, 98 per cent, was satisfactory.

The final result was doubtful in two patients with small rectovaginal fistulas when discharged from the hospital, 2 per cent, as no follow-up could be obtained.

SUMMARY AND CONCLUSIONS

The life of J. Marion Sims, called the "Father of Gynecology," is reviewed, and the story of vesicovaginal fistula is depicted. During Sims' days vesicovaginal fistula was almost entirely of obstetric origin, but since then, with the advent of asepsis, so many surgical operations are performed on the female pelvic organs that most of the vesicovaginal fistulas encountered are of surgical rather than obstetrical origin. The first successful operation for this distressing malady was performed by Sims on a slave girl in 1849, this being the thirtieth operation that he had performed on this patient. His success was due to the use of silver-wire sutures, failures having been encountered in the previous twenty-nine operations, when he had used other suture material. His operation has been responsible for restoring women so afflicted to a useful life by overcoming one of the most tormenting disorders to which womankind may be subjected. The story of his life shows how obstacles that seemed insurmountable were overcome.

The preparation of the patient and the after-care are described and twenty-six personal cases are reported. The cure of vesicovaginal fistula depends upon careful preoperative preparation, meticulous technic, attention to small details and painstaking postoperative care, preferably in the hands of the operator himself.

A complete laceration of the perineum and its frequently accompanying rectovaginal fistula may be prevented by resorting to one of three methods when the indication arises: perineotomy, episiotomy, or manual dilatation of the perineum and vagina.

Perineotomy or median perineal incision is valuable when the disproportion between the presenting part and the vaginal outlet is moderate.

Episiotomy, or lateral perineal incision, should be employed when a great deal of room is required, as in difficult forceps operations, and in the presence of a large presenting part.

Manual dilatation of the perineum and vagina is a satisfactory method of preparing the birth canal before version and extraction operations.

The technic of operation for repair of complete laceration of the perineum and rectovaginal fistula is discussed.

The preoperative and postoperative care are described.

The gentle handling of the tissues and their careful approximation with fine suture material applied without tension is stressed.

One hundred ten personal cases are reported.

The end result was satisfactory in 108 patients, 98 per cent, sixteen of whom, 15 per cent, developed postoperative complications. In two patients, approximately 2 per cent, discharged from the hospital with small rectovaginal fistulas, the final result could not be ascertained.

Sulfasuxidine, administered two weeks preoperatively and postoperatively, as soon

as tolerated, may modify the intestinal bacterial flora in such a way that it may further reduce postoperative infections.

A careful preoperative preparation, meticulous technic, gentle handling of the tissues, sharp rather than blunt dissection when feasible and postoperative care under the immediate supervision of the operator all play an important rôle in securing satisfactory healing.

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THE USE OF CARBOLIC ACID (PHENOL) IN THE TREATMENT OF BARTHOLINIAN ABSCESS

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THIS short communication is concerned with the treatment of Bartholinian abscess by incision and use of carbolic acid (phenol).

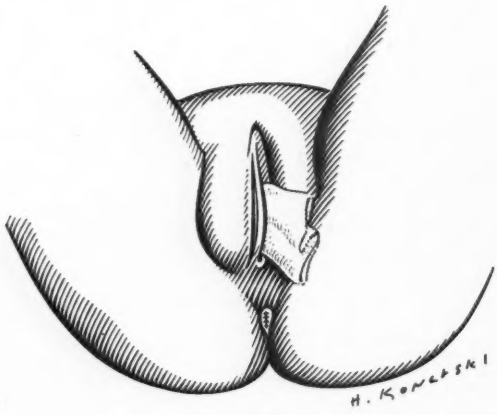

FIG. 1. Gauze or cotton placed in the vagina. The incision of the abscess is at the junction of the skin and mucous membrane.

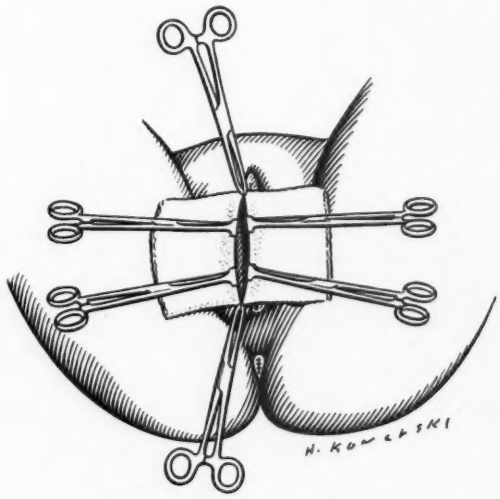

FIG. 2. After incision and evacuation of the abscess alcohol gauze is applied to the wound edges with Allis clamps.

Caspar Thormerson Bartholinius (1655–1738), born in Copenhagen, was the first anatomist to describe the glands which bear his name. In the years following his death there has been much controversy concerning their function and their relation to gonorrheal infection. Not so long ago it was believed that all infections of these glands were of gonorrheal origin. Today it is generally held that not more than 60 or 70 per cent of Bartholinian abscesses are of gonorrheal origin. This has been the writer's experience.

In a review of my own clinical experience, and of the writings of the old clinicians whose methods have been lost sight of, I can find no mention of this method (i.e., the use of phenol) in the cure of a Bartholinian abscess, although there is mention of its use in many similar conditions.

The evacuation of a Bartholinian abscess is a simple matter but the permanent cure of the same is another story. An evacuation may at times cure the condition, especially if the abscess cavity is packed following the evacuation. This method is not to be recommended, despite a few cures, because recurrences are too frequent. The desire to enucleate the gland and its contents must be equally condemned as infection almost invariably ensues, leaving in its wake a distorted vulva.

"Like all compound glands, it is surrounded by connective tissue which forms a more or less definite capsule."[1]

Despite the toxicity of carbolic acid, which is textbook knowledge, we have found its use safe according to the technic

we employ in the cure of these abscesses. Careful analysis of the urine in our laboratory has failed to show any sign of carbolic acid excretion in any case, and at no time has any patient shown, symptomatically, signs of carbolic acid poisoning.

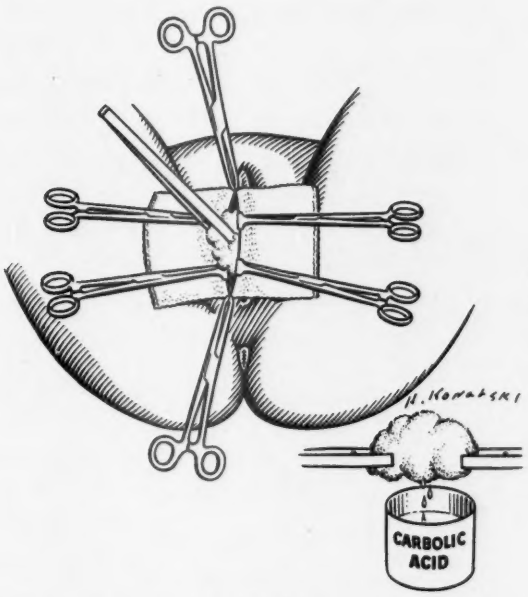

Fig. 3. Insertion of carbolized cotton to abscess cavity. Smaller illustration shows method of removing excess phenol.

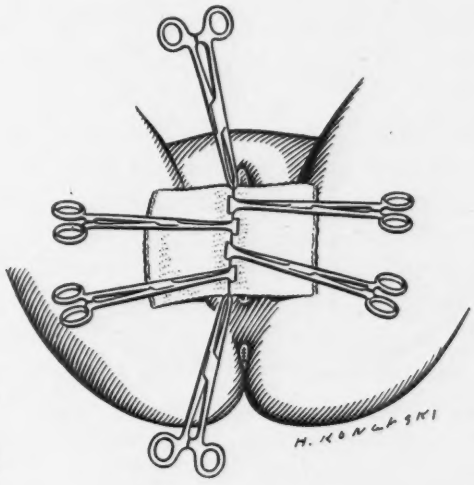

Fig. 4. The handles of the Allis clamps reversed while carbolized pack is in abscess cavity.

Technic. The orifice of the vagina should first be packed with a small insert of cotton or gauze. (Fig. 1.) The egg-shaped mass of the vulva, the site of the abscess, is excised from top to bottom, the line of incision following the junction of the vulva squamous epithelium with that of the mucous membrane. The gloved finger is then introduced and, with gauze, the abscess cavity is evacuated.

Two 4 by 4 inch gauze dressings are dipped in alcohol, wrung out, and attached to the cut edges with Allis clamps. (Fig. 2.) This prevents the acid's excoriating the skin or mucous membrane.

Next, a bolus of cotton, approximately the size of the abscess cavity, is dipped in carbolic acid and the excess squeezed out, using forceps. (Fig. 3.) (*Warning: Be sure not to handle this bolus with the gloved hand.*) The impregnated cotton is now inserted into the abscess cavity and the cut edges approximated by reversing the handles of the clamps, already applied (Fig. 4), to hold the alcohol gauze. The impregnated cotton is allowed to remain in the cavity *one and a half minutes* and is then removed. The cavity is then swabbed with alcohol.

Inspection is now made to see that the eschar is complete. If any point is found not carbolized, this can be accomplished by a little carbolized cotton on the end of a probe. The cavity is now packed with plain or iodoform gauze, and the edges of the incision are approximated with two plain catgut sutures. (Fig. 5.)

A local anesthetic is not satisfactory. We have used either gas, epival or other intravenous anesthetics, as the operation should not take more than ten to fifteen minutes. The only preparation for this operation is shaving of the vulva. We still use an application of iodine to the parts before incision is made. We leave the cotton or gauze in the vagina until the end of the operation, when it is removed.

After the operation, the patient is placed on an unrestricted diet, with fluids as desired.

Little or no pain is encountered until the third or fourth day, at which time the patient complains of tenderness and at

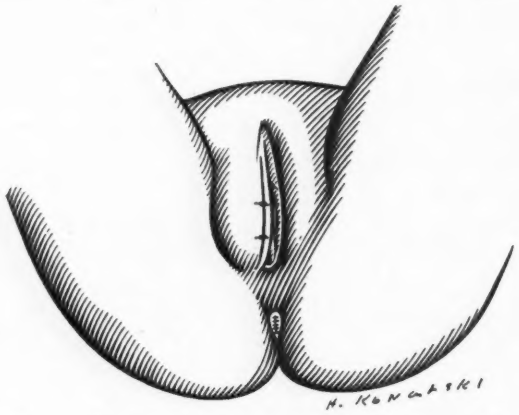

Fig. 5. The carbolized pack has been removed, the cavity swabbed out with alcohol, the cavity repacked with plain or iodoform gauze and the wound sutured with two plain catgut sutures.

times pain. At this time the sutures are cut; the packing, moistened with peroxide, are removed and another light packing is inserted. The patient is now allowed to go home and is instructed to return to the office for ambulatory treatment, which consists of repacking every other day. Usually within two weeks the abscess cavity is entirely obliterated, healing consummated, and little or no scar results.

We have used this method of treatment for the last ten years. Recurrences have been nil, distortion of the vulva nonexistent, and as far as the patient is concerned, the operation is without subsequent pain.

This technic is used not only in our clinic, but in the College Division of Kings County Hospital, and at Greenpoint Hospital.

CONCLUSION

The technic of the treatment of Bartholinian abscess by incision, drainage, and the use of carbolic acid, together with the after-treatment is described. This treatment has given satisfactory results in our clinic for the past ten years. The simplicity of the technic is a real recommendation.

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CONTINUOUS CAUDAL ANESTHESIA IN OBSTETRICS*

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THE relief of pain during labor has been the subject of much discussion, clinical observation and research in the past half century. It is true that some labors are short and the pain is well tolerated; yet, many labors are prolonged, and the patients desire and expect freedom from pain or some amelioration of their suffering. Relief of pain is more readily resorted to in most other conditions. Reluctance to the use of pain-relieving measures in obstetrics is apparently due to the possible effect on the parturient and the fetus. Refinement in surgical procedures followed the improvement in methods of anesthesia and the discovery of new anesthetic agents. Surgery, the spearhead of medical progress, can be said to have made most of its expansion because of the advancements in anesthesia.

In obstetrics, a suitable pain-relieving agent is sought that will also be safe for the mother and baby, and will not interfere with the normal processes of labor. Many forms of obstetric analgesia have been used in the past and many clinics have adopted one or a combination of more than one and have applied them efficiently with marked success. Most of these provide amnesia or loss of memory during the first stage of labor; but for the completion of the second stage, in most instances, an inhalation anesthetic is usually necessary. This latter procedure invariably causes marked depression of the respiratory center of the newborn resulting in asphyxia. In many instances, it has had a similarly bad effect on the respirations of the parturient causing pulmonary complications, respiratory depression and even death. General anesthesia, moreover, is known to cause relaxation of the uterus with concomitant increase in uterine bleeding. The value of a method that will produce relief of pain during the first stage of labor, permit painless progress of the second stage, and still serve as an adequate anesthetic during delivery, whether spontaneous or operative, approaches closely to the needs of the accoucheur.

It is universally agreed that the various methods of anesthesia and analgesia in obstetrics heretofore in vogue fall short of meeting the above requirements of safety to mother and baby. One after another has been tried. Each had its day and each was discarded or used under compulsion for want of anything better.

The use of caudal anesthesia in obstetrics dates back to 1909 when Stoeckel[1] applied it to relieve pains during labor. Prior to that, it was atempted by Cathelin,[2] in 1900, when he blocked the sacral and coccygeal nerves through the sacral hiatus for pelvic and perineal surgical procedures. This method of anesthesia did not have many followers at first; but after the work of Löwen,[3] in 1910, it became more acceptable. Continuous caudal analgesia, as described by Hingson and Edwards[4] seems to answer all the requirements of a satisfactory obstetrical analgesic and anesthetic.

Many attempts have been made before to secure high anesthesia by increasing the quantity of anesthetic fluid and by increasing the force of injection. This has met with a great many failures. Attempts at placing the patient in the Trendelenburg position has also met with failure. The reason for these failures has been thought to be due

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to the relatively firm connective tissue attachment between the inner wall of the vertebral canal and the dural sac, hindering proper diffusion of the drug. However, with the use of 1.5 per cent metycaine solution, as advocated by Hingson and Edwards,[4] it has been possible to produce a greater upward diffusion of the anesthetic fluid and thus produce a higher level of anesthesia. By this means, an epidural anesthesia is produced through the caudal canal.

FIG. 1. Anatomical landmarks. A, cornua of sacrum and sacral hiatus. B, sacrococcygeal ligament covering hiatus.

Difficulties in securing effective caudal anesthesia are due to anatomical variations of the sacrum, which is composed of the union of the sacral vertebra. It is a cuneiform bone, flattened, with a marked anterior concavity. Inferiorly it unites with the coccyx. Vertically on both sides, about 2 cm. from the midline, are four or five sacral openings through which run the anterior branches of the sacral nerves. The sacrum posteriorly is convex, especially in the vertical axis. It presents many prominences, the last of which represents the upper limit of the sacral hiatus. The posterior surface of the sacrum is therefore the part that is important to the anesthetist in initiating caudal anesthesia.

The sacral hiatus is limited below by two sacral horns (Fig. 1A) which point downward to meet the horns of the coccyx. Above, the hiatus is limited by the spinal processes of the last sacral vertebra. This has the shape of an inverted V.

The contents of the sacral canal are connective and adipose tissues rich in blood supply and sacral nerve roots which are covered by dura and spinal ganglia. The dural sac extends downward only to the second sacral segment. (Fig. 2.)

The effect of caudal block on nerves supplying the pelvic organs and the perineal structures has been fully described by Hingson and Edwards[4] and Lahman and Meitus.[5] They state that painless, uneventful labor has progressed satisfactorily in patients with lesions in the spinal cord or injuries to the cord. Experimentally, such painless labor has been produced in laboratory animals.

Caudal block serves to anesthetize the sacral nerves and abolishes all the pain impulses to the uterus, cervix, vagina, and perineum; but does not affect the rythmic uterine contractions characteristic of normal labor.

We have used continuous caudal anesthesia since February, 1943, in 250 cases, according to the method described by Hingson and Edwards.[4] We found that the best position is the left lateral or Sims position, as shown in Figure 3. The buttocks are placed at the edge of the bed and the right thigh is flexed on the abdomen and the right leg is flexed on the thigh. The left lower extremity is held in extension. This posture makes for an easier approach to the sacral hiatus as indicated in Figure 3.

The sacral hiatus is best located by first palpating the tip of the coccyx which lies deep in the anal fold. About one and one-half inches above the tip of the coccyx, one can feel a small depression, which is limited laterally by two horns of the sacrum. This depression is the sacral

hiatus through which the needle is inserted. (Fig. 1A.)

A small wheal with 1 per cent novocaine solution is made slightly distal to the depression. Then using a fine intramuscular needle (No. 19 gauge), a little more of the same anesthetic solution is injected into the subcutaneous tissue and the sacrococcygeal ligament (Fig. 1B), which is the laminal closure of the sacral hiatus. A five minute wait is necessary for this area to be sufficiently anesthetized. The flexible No. 19 gauge needle as described by Hingson and Edwards[4] is first introduced perpendicular to the skin. It traverses the skin, subcutaneous tissue and then pierces the sacrococcygeal ligament into the sacral hiatus. The distal end of the needle is then tilted so as to lie, more or less, parallel to the sacral plane and the needle is pushed in further into the sacral canal, usually through its entire extent. The needle, when inserted properly, should feel firm and not easily dislodged from its fibrous tissue entrance.

With needle *in situ*, the stilet is withdrawn. One observes then whether spinal fluid or blood appears. If spinal fluid appears, the needle should be withdrawn and this form of anesthesia should not be attempted. If blood is observed, the needle should be readjusted by withdrawing it slightly and deflecting the needle downward away from the blood plexuses located on the anterior wall of the sacrum. The anesthetic fluid may then be injected.

The initial dose of 30 cc. of 1.5 per cent metycaine solution is given in divided doses of 8 cc., 10 cc., and 12 cc. at about five to eight minute intervals, depending upon the rapidity of appearance of anesthesia. Before giving each of these injections, one should withdraw the plunger of the syringe to make certain there is no entrance of anesthetic fluid into a vein. The anesthetic fluid should be injected slowly and should enter the canal freely. During the injection, the palm of one hand is held over the sacral area exerting slight pressure. This is done to detect the possibility of subcutaneous infiltration should the needle have been incorrectly inserted.

When the needle has been inserted properly, anesthesia begins to appear in five to eight minutes after the first injection of 8 cc. of metycaine. Complete relief of labor pains is noted five minutes after the last injection of 12 cc. The progress of anesthesia is noted to be as follows: (1) The region of the coccyx (coccygeal nerve plexus) appearing in five to eight minutes; (2) region of the rectum (hemorrhoidal nerve plexus) in eight to twelve minutes; (3) region of the perineum (perineal nerve plexus) in twelve to fifteen minutes; (4) the vulva area (pudendal nerve) in fifteen to eighteen minutes; (5) inguinal region (ilioinguinal nerve) in eighteen to twenty minutes; (6) areas midway between the symphysis and umbilicus (ilio-hypogastric); (7)

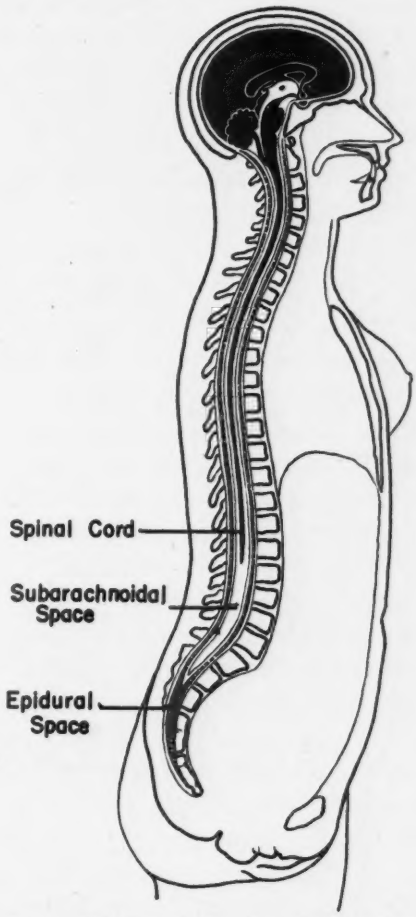

Fig. 2. Schematic drawing showing the extent of subarachnoidal space (white) and epidural space (dotted).

area midway between the symphysis and umbilicus to the umbilicus (eleventh and twelfth thoracic nerve).

soundly are the ones who have had one or more disturbed nights before active labor began.

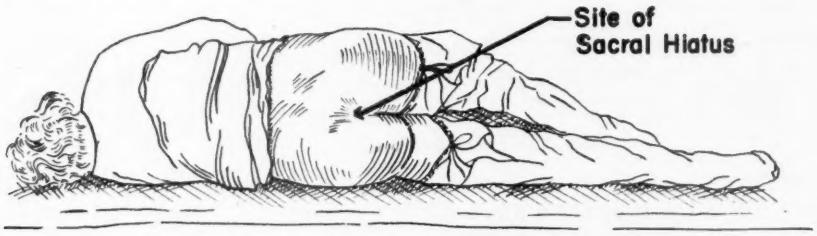

Fig. 3. Position of patient for insertion of needle.

The signs that the anesthetic fluid is properly injected into the epidural space of the sacral canal are: (1) The ease with which the fluid enters the sacral canal. (2) pain in leg (usually left) when fluid is being injected. This is known as the "sciatic sign" which is not always elicited. But, when it is present, one can be certain that the solution is entering the sacral canal; (3) marked relaxation of the anal sphincter permitting the introduction of two fingers with ease; (4) the feet and legs, after ten minutes, become warm, pink and dry. This is due to the paralysis of the vasoconstrictor fibers of the sympathetic nerves.

The continuous caudal apparatus as described by Hingson and Edwards[4] is attached to the needle only after one is assured that it is properly inserted and anesthesia is taking effect progressively from the coccygeal area up to the umbilicus. In order to secure complete relief of labor pains, the level of anesthesia should be maintained up to the level of the umbilicus. When anesthesia goes below this level, an additional injection of 20 cc. of 1.5 per cent metycaine is to be given through the attached continuous caudal apparatus. As a rule, these injections are necessary every thirty-five to forty-five minutes.

With the relief of labor pains, the patient is relaxed and at ease. The only sign of continuing labor is when a hand on the abdomen feels the uterine contractions of the same frequency and intensity as before the administration of the anesthetic fluid. The parturient often dozes off into sound sleep and is able to take nourishment throughout her labor. Those who sleep

Mild toxic symptoms due to the anesthetic were noted in about less than 5 per cent of the patients. These patients were slightly nauseous, dizzy and at times, vomited. Aside from these mentioned discomforts, our patients had no untoward immediate symptoms from the administration of continuous caudal anesthesia and were completely free from pain. Several patients had mild circulatory disturbances which will be discussed later.

Additional injections of the anesthetic are repeated at intervals as stated above when the level of anesthesia falls much below the level of the umbilicus, or when the patient becomes aware of returning pains. The patient may be permitted to lie on either side or on her back, which ever position gives her most comfort.

Rectal examinations are done at intervals to follow the progress of labor. When the patient is fully dilated and the presenting part is low enough for delivery, or the patient has been fully dilated for a sufficient time without progress, labor should be terminated. An additional 20 cc. of anesthetic is then injected into the caudal canal and the needle is removed. The patient is then placed on the delivery table and prepared for delivery. The entire delivery is usually completed within the anesthesia time limit of the last injection, which is about forty-five minutes.

This procedure of removing the needle immediately prior to placing the patient on the delivery table is, of course, optional. Others transport the patient to the delivery table with the needle *in situ* and the apparatus attached. They do this, apparently,

to make certain of anesthesia should the delivery take longer than forty-five minutes. It has been our experience that the forty-five minutes is ample time to complete any pelvic delivery.

The amount of anesthetic fluid used for the entire labor and to complete the delivery varied. The lowest amount used was 30 cc. and the highest amount was 330 cc., the average being 120 cc.

FINDINGS IN 250 CASES

We wish to report our experience and observation in 250 patients delivered under continuous caudal anesthesia. There were 239 patients delivered by the pelvic route and the remaining eleven were delivered by cesarean section. Of the 239 pelvic route deliveries, 191 were primipara and forty-nine were multipara. Our criteria for suitability of the use of this form of anesthesia were regular uterine contractions, recurring every three to five minutes, the cervix at least 3 to 4 cm. dilated and effaced, and presenting part engaged or engageable.

The average first stage in the multipara lasted one and three-fourth hours and in the primipara three and one-half hours. The longest first stage in multipara was five and one-half hours and in primipara it was fifteen hours. The shortest first stage in multipara was twenty minutes and the shortest first stage in primipara was thirty minutes.

We consider among these 239 cases, 232 successful and seven failures. A case was deemed successful if after completion of the three initial injections, totaling 30 cc. of 1.5 per cent metycaine, the perception of pain disappeared. Also, that at the same time, uterine contractions continued at the same frequency and intensity as before the administration of the anesthetic. The anesthesia was further considered to be successful, when delivery could be effected under continuous caudal anesthesia without being supplemented by any other form of anesthesia.

A case was considered a failure when it did not meet all the above criteria. Among the seven failures, four went to full dilatation without pain under continuous caudal anesthesia, but at this point, the needle became dislodged and re-insertion was difficult. These four cases were partial successes in as much as during the first stage and part of the second stage, the patient was free from pain. These deliveries were completed with gas oxygen anesthesia. The other three failures were considered total failures because although the needle appeared to be properly inserted in the caudal canal and the anesthetic fluid entered with apparent ease, the perception of pain did not cease and the needle had to be withdrawn and this form of anesthesia discontinued. In two of these cases, infiltration of the skin was later detected. In another case, no adequate explanation can be offered. There are six additional cases, not included in this study, in which an attempt to enter the sacral hiatus failed. Obesity and general distortion of the usual anatomic landmarks might be a cause of inability to enter the hiatus.

Table 1
METHOD OF DELIVERY

Method	Primipara	Multipara	Success	Failure
Spontaneous	2	10	11	1
Low forceps	159	32	188	3
Midforceps	4	1	4	1
Manual rotation and midforceps	16	6	21	1
Forceps rotation	8	0	8	0
Breech extraction	1	0	0	1
Version (2nd of twin)	1	0	1	0
Cesarean section	8	3	10	1
Total*	199	52	243	8

* One case of twins.

Table 1 reveals further that twelve spontaneous deliveries occurred under this form of anesthesia. The remaining number were delivered by forceps. The high incidence of forceps deliveries can be explained by the fact that although the patient is conscious and willing to co-operate, the bearing down sensation is completely absent. Despite regular frequent uterine contractions, she

is unable to make use of her auxiliary expulsive powers. The second stage of labor may therefore be said to be delayed unless terminated by operative procedure, an experience common in all cases in which some form of obstetrical analgesia is used. Precipitate labor has not occurred and is very rare under this form of anesthesia.

labor; and this stage is completed in better than average time without the assistance of any oxytoccic drugs. Soon after the delivery, there is practically no bleeding from the uterus. There were no retained placentas in this group and there was no instance of immediate postpartum hemorrhage, either during or after the completion of the third stage. The placenta was separated and expressed within five minutes in twenty-eight patients. In one instance, it did not separate for twenty-five minutes. The average duration of the third stage under continuous caudal anesthesia was eleven and one-half minutes. The uterus was firm after the third stage was completed and remained so for the entire puerperium. In only one patient, relaxation of the uterus with accumulation of clots was noted when the patient had already been transferred to her bed two hours after the delivery. After the clots were expressed, she presented mild symptoms of shock, undoubtedly due to the loss of blood. Instant treatment with infusion of glucose and saline and plasma, restored her to normal. As a rule, during the puerperium, involution progressed satisfactorily.

TABLE II

TIME FOR COMPLETION OF FIRST STAGE OF LABOR

Time	Hours																Lowest	Highest	Average
	0–½	½–1	1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	9–10	10–11	11–12	12	15			
Primipara...	1	2	7	37	46	45	17	8	8	4	5	1	1	2	1	2	30 minutes	15 hours	3½ hours
Multipara...	3	5	13	10	8	2	4	1	..	..	..	..	..	..	..	..	20 minutes	5½ hours	1¾ hours

Correction of occipitoposterior positions by manual or forceps rotation occurred thirty times. With the cervix fully dilated, effaced and retracted over the head, a right or left occipitoposterior is easily rotated to an anterior position, and delivery is accomplished by forceps. Similarly, Kiejland forceps rotation and Scanzoni maneuver were done to correct posterior positions on eight occasions.

In this series, we managed one case of twins in a primipara. The first baby, weighing 5 pounds 6 ounces, was delivered by low forceps. The second baby, was delivered by version and breech extraction ten minutes after the birth of the first. This baby weighed 6 pounds 7 ounces. The version was performed without undue difficulty, but the maneuver had to be accomplished between uterine contractions with the hand in the uterus all the time.

One breech presentation was managed with continuous caudal anesthesia. When the patient reached full dilatation, progress was slowed and the needle became dislodged and re-insertion was not successful. The delivery was accomplished under supplementary inhalation anesthesia.

There is a remarkable diminution in loss of blood during the third stage of

The repair of episiotomy or additional lacerations was carried out under the same anesthesia. We noted more bleeding from the pelvic floor lacerations and episiotomies. This is due to the vasodilatation of the perineal vessels generally common in caudal block. The repair is easily accomplished without much hurry which often becomes necessary under a

general anesthetic. There is no marked distortion of parts or uncertainty of anesthesia, as when the perineum is infiltrated locally.

TABLE III
DURATION OF THIRD STAGE

Time	Number of Patients	Retained Placenta	Immediate P.P.H.
5 minutes	28	0	0
5 to 10 minutes	38	0	0
10 minutes	106	0	0
10 to 15 minutes	2	0	0
15 minutes	47	0	0
20 minutes	11	0	0
25 minutes	1	0	0
Total*	233	0	0

* Eleven cesarean sections and six complete failures not included.

Cesarean section was done eleven times under continuous caudal anesthesia. Three were repeat sections; one patient was suffering from rheumatic heart disease; one, from toxemia of pregnancy; the other six patients had cesarean sections performed for cephalopelvic disproportion. Of the last group, two patients had had trial labor for eight to ten hours under this method of anesthesia. When no progress occurred in descent, after that period of time, the patients were prepared for operation and with the needle *in situ*, they were transferred to the operating room. In all cases, there was complete abdominal relaxation. The infant was extracted with ease and removal of the placenta was accomplished without difficulty. The uterus was firm and well contracted during and after the operation and there was a minimum amount of blood loss. There was no drop in blood pressure and the patients had no nausea or vomiting during the entire operative procedure. Postoperative convalescence was smooth and uneventful. One of these patients needed supplemental gas oxygen anesthesia during the operation because the level of anesthesia was not high enough. All sections were of the low cervical type with transverse incision into the uterus.

There were no maternal mortalities or near deaths as reported by Block and Rochberg.[6] However, five instances of mild circulatory collapse as described by Siever and Mousel[7] were noted. These patients appeared pale, listless, apathetic, nauseous, with noticeable shaking of upper extremities, head and trunk. There was a considerable drop in blood pressure (30 to 40 mm.). This condition was noted as a rule close to the delivery or early in the postpartum period and continued for a short period of time, not longer than ten hours. No particular therapy was instituted but external heat, forcing of fluids and sedation were generally sufficient to restore them. On two occasions, administration of caudal anesthesia resulted in apprehensiveness, restlessness, and increased pulse rate in the mother and a concomittant increase in the fetal heart sounds. Both of these patients improved immediately when glucose was administered intravenously and 1 cc. of adrenalin (1–1000) was given subcutaneously. In our later cases we followed the suggestion of Block and Rotstein[8] and we added ephedrine to the metycaine solution. We had subsequently found fewer instances of circulatory disturbances. Aside from the incidents mentioned above, there were no maternal morbidities that could in any way be associated directly or indirectly with the administration and use of continuous caudal anesthesia.

All newborns cried spontaneously on delivery and none required the use of artificial methods of resuscitation. There were two still-births in this series. Both were due directly to traumatic forceps deliveries. One case was misjudged as to the cephalopelvic adequacy. The head entered the pelvis but was arrested at the spines, and after much difficulty and several applications of forceps, a still-born, severely traumatized, fetus was delivered. Another still-birth occurred in an elderly primipara who displayed evidence of apprehension,

rapid pulse and accelerated fetal heart tones soon after the administration of continuous caudal anesthesia. When she was ready for delivery several hours later, both the patient's condition and the fetal heart sounds were much improved and considered normal. Attempts at forceps extraction failed. Other attempts at forceps extraction following manual rotation for the correction of an undiagnosed occipito-posterior position also failed. An internal podalic version was finally done and a still-born fetus was delivered. This last procedure was done under gas oxygen ether anesthesia because the continuous caudal anesthesia had, by that time, worn off.

One neonatal death occurred after an easy low forceps delivery in a primipara nine hours in labor and under continuous caudal anesthesia for four and one-half hours. The child was cyanotic, had difficulty in breathing, breathed irregularly and expired during the first twenty-four hours. Postmortem examination revealed atelectasis of the lungs and no evidence of intracranial damage. There was a neonatal morbidity in an immature newborn, which early in its neonatal life developed evidence of cerebral trauma. The baby subsequently improved and was discharged on the fourteenth neonatal day.

In spite of the great preponderance of forceps deliveries, (over 94 per cent), we found the average loss of blood as determined by clinical observation to be considerably less than with other forms of anesthesia. The uterus is well contracted and firm. In fact, the usual dose of pituitrin or ergotrate routinely used can very well be dispensed with.

As the anesthesia wears off, the patient is conscious of pain in the lower abdomen and perineum. This pain is relatively exaggerated; for the sudden transition from a painless labor and delivery, to even moderate pain, causes the patient much discomfort and apprehension. We have, therefore, administered to most patients, morphine sulfate gr. ¼ soon after delivery.

In our series of 250 cases, a small percentage had either retention of urine after delivery or difficulty in voiding. In such cases, one or two catheterizations became necessary. The reason for such retention is probably atonicity of the bladder. We are conscious of the fact, however, that after operative or even spontaneous deliveries, a certain percentage of parturients will have bladder difficulties. Our percentage of urinary disturbances, therefore, cannot be considered as a complication, certainly not to the extent of considering it as a contraindication to continuous caudal anesthesia.

Low back pain was a frequent complaint of many of the patients. This varied in degree from a mild pain over the site of injection, which disappeared in twenty-four hours, to quite severe pain which lasted several days. The latter was the exception, not the rule. Heat applied to the site of the painful area seemed to relieve those of the more severe type. Patients are able to move about freely soon after delivery and are encouraged to do so. Intake of liquids and other food can be commenced at once.

The involution of the uterus and character and amount of the lochia has not differed in any respect than heretofore without this form of anesthesia. The episiotomies healed in the normal fashion and we did not note any difference in the healing or discomfort in that area. Painful and edematous hemorrhoids were not as frequent as in deliveries with other types of anesthesia. This is explained by the absence of bearing down during labor and the marked rectal relaxation under continuous caudal anesthesia.

The entire postpartum course, otherwise, differed in no way other than the usual. The patients lie on their abdomen on the fifth day, sit up in bed on the seventh and are out of bed on the eighth day. They are discharged from the hospital on the ninth day postpartum.

SUMMARY

1. Relief of pain during labor and delivery is now recognized to be a "must" in modern obstetrics.

2. Continuous caudal anesthesia in obstetrics was used in a series of 250 patients, 239 pelvic deliveries and eleven cesarean sections.

3. Cervical dilatation is markedly facilitated, thereby shortening the first stage of labor.

4. The entire labor and delivery can be accomplished under one form of anesthesia.

5. In general, there were no untoward effects upon the mother. However, a few instances of mild circulatory disturbances were noted and easily combatted.

6. The results upon the fetus were good. The causes for the still-births and the neonatal morbidities do not appear to be due to this form of anesthesia.

7. There was a definite diminution in blood loss.

8. Operative procedures are greatly facilitated, due to the relaxed pelvic parts.

9. Inhalation anesthesia to terminate labor with its resultant dangers and complications is avoided.

10. The postpartum course does not differ in any respect from any other form of delivery.

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CULDOSCOPY*

A NEW METHOD IN THE DIAGNOSIS OF PELVIC DISEASE—PRELIMINARY REPORT

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ENDOSCOPY as a diagnostic procedure is now being utilized frequently in all departments of medicine. The direct view of the gross pathology in various hollow viscera, as revealed by the endoscope, is of distinct diagnostic value. The instrument enables one to remove tissue for biopsy from these organs and also to photograph their interior. The bronchoscope, the gastroscope and the cystoscope, when competently applied, have proved their value.

The peritonescope has many advocates who ascribe definite advantages to its use in the diagnosis of intra-abdominal and pelvic conditions. Ruddock's[1] statistical analysis of 900 cases established the value and safety of the procedure. More recently Belings[2] has pointed out the indications for the use of the procedure and emphasized the importance of the instrument on determining the presence or absence of liver metastasis and hepatic cirrhosis. Meigs[3] emphasized the importance of the peritonescope in the differential diagnosis of suspected pelvic growths. Hope[4] reported ten cases of unruptured ectopic gestation diagnosed by the peritonescope.

One of us (A. D.) has used the peritonescope as an aid in the diagnosis of upper abdominal and pelvic disease. The instrument was used in cases of suspected gallbladder and hepatic disease and pelvic conditions such as, small ovarian disease, tubal occlusion, endometriosis, and suspected ectopic pregnancy. The procedure was reserved for those cases in which the usual methods of diagnosis gave inconclusive results and the diagnosis was a matter of conjecture. The route to the pelvis by abdominal puncture with the aid of vaginal manipulation and various postures did not give uniformly satisfactory results. The failure of proper visualization was usually due to the presence of intestinal loops and the inability to isolate the pelvic organs properly.

Efforts to improve the usefulness of the instrument in pelvic diagnosis has led to the adoption of the vaginal route to view the pelvic organs. This procedure we have termed culdoscopy. It gives uniformly good results and has led to the adoption of other new diagnostic procedures such as, the dye test for tubal patency. When the procedure is carried out as described in properly selected cases, one can obtain all the visual and some of the palpable information that is otherwise obtained only by laparotomy.

In cases of sterility very definite information can be obtained concerning the condition of the Fallopian tubes and the ovaries. When tubal occlusion is present, the character and location of the obstruction can often be viewed. The location and size of the aperture in the partly occluded fimbriated end of the tube is visible. The ovaries can be examined minutely and the size and presence of follicle, corpora lutea and small cysts can be observed. Small areas of endometriosis are plainly visible and the degree of pelvic and intestinal adhesions can be determined.

* From the surgical service of Dr. John V. Bohrer, Knickerbocker Hospital and the Gynecological Department of the New York Post-Graduate Medical School and Hospital.

THE INSTRUMENT AND DESCRIPTION OF THE PROCEDURE

The instrument consists of a culdoscope, as illustrated. A trochar and cannula has been especially designed to facilitate puncture of the cul-de-sac. A modified Colvin type of self-retaining cervical cannula with detachable tubing is essential. A perineal retractor or Sim's speculum is necessary. Other parts of the equipment include a 20 cc. syringe, a curved volsellum and thigh straps.

The examination is made in the knee-chest position as no other posture gives satisfactory results. Well fitted shoulder braces, upright leg holders and thigh straps are used to support the patient in the knee-chest position. When properly applied the patient can maintain this position for as long as one and one-half hours without distress.

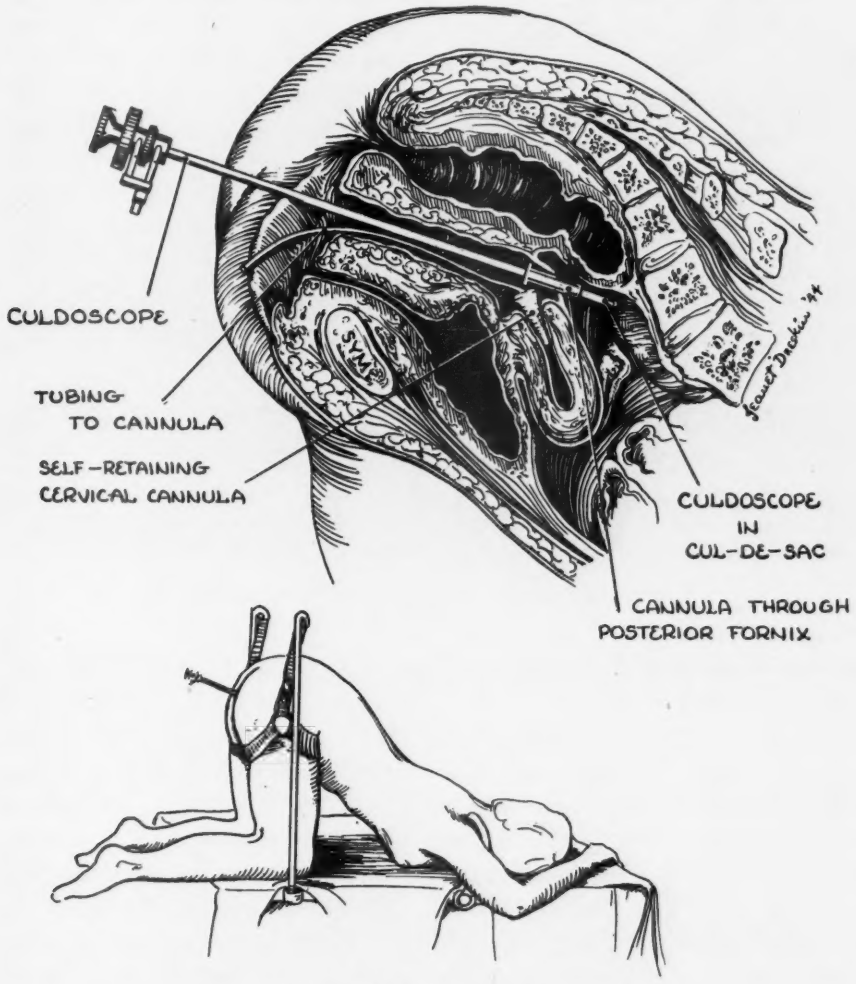

FIG. 1. The culdoscope is shown in the cul-de-sac and the screw tip cervical cannula is in the cervical canal. The lower figure illustrates the proper method to maintain the knee-chest posture.

Anesthesia. Caudal anesthesia with 30 cc. of 1 per cent metycaine gives excellent results and allows for many intrapelvic manipulations and procedures. Local infiltration of the vaginal vault with 10 cc. of 1 per cent novacaine will usually suffice.

The infiltration of 30 cc. of 1 per cent novocaine in the region of the presacral nerve by the pararectal route has given satisfactory results together with local infiltration at the point of puncture of the

vaginal vault. When caudal anesthesia is used, the patient is placed in the knee-chest position after the anesthesia has been injected.

Fig. 2. Self-retaining screw tips for the cervical cannula.

Procedure. The perineum is elevated slightly with the Sim's speculum. The cervix is grasped with the curved volsellum and drawn down. The vaginal vault is infiltrated with 10 cc. of 1 per cent novocaine at the point where it leaves the posterior surface of the cervix.

The self-retaining cervical cannula is then screwed into the cervix and the flexible tubing attached. The trochar and cannula are then poised at the point in the vaginal vault where the posterior vaginal wall leaves the cervix. The point of the trochar is directed slightly downward toward the central point of the pelvis. The trochar is thrust through the vault of the vaginal. Entrance into the cul-de-sac is attested by the sound of inrushing air on removing the trochar. The cannula is left in place and the culdoscope is inserted into the pelvic cavity and the contents of the pelvis viewed.

The Fallopian tubes, ovaries, anterior and posterior surfaces of the uterus, sigmoid, rectum, broad ligaments, uterosacral ligaments, promontory of the sacrum, loops of the small bowel, and in some instance the appendix are plainly visible.

In the visualization of the pelvic structures the posterior surface of the uterus comes into view readily. The instrument is directed toward the right side and the right tube and ovary are brought into view and their position and condition observed. The presence of cysts, clubbing or inversion of the fimbria are readily discernible. The instrument is then rotated to the left side and similar observations are made of the left tube and ovary. Further rotation of the instrument brings the uterosacral and the rectosigmoid region into view and observation at the brim of the pelvis reveals the iliac vessels, the infundibulopelvic ligament and ovarian vessels and above the brim loops of the small intestines are seen and occasionally the appendix.

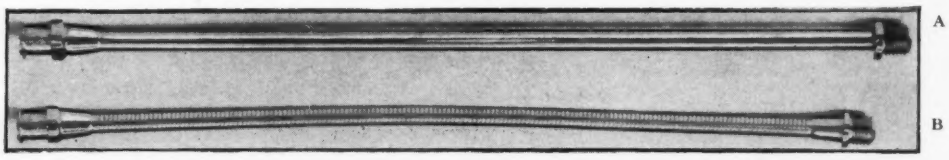

Fig. 3. A, rigid cannula for the screw tips; B, flexible cannula for the screw tips.

The cervix may now be manipulated and the anterior surface of the uterus and partially distended bladder can be observed. When a diluted solution of Indigo carmine (5 drops to 50 cc. of saline) is injected through the cervix by means of the self-retaining cannula, the dye can be seen to distend the tube. Patency is established when the dye exudes from the fimbriated end of the tubes. Any clubbing of the fimbriated end is well viewed. The thickness of the tube and of the clubbed end can be estimated by the amount of color transmitted through the wall.

When the examination is completed the culdoscope is removed and the cannula left in place. A bolster is placed under the abdomen and the thigh straps and shoulder braces are released. The patient is placed on her abdomen over the bolster and the abdominal air expelled. The cannula is then removed. This procedure reduces to a minimum the shoulder pains that result from the presence of air in the upper abdomen.

When one becomes familiar with the procedure, many manipulations such as rupture of small cysts, biopsy of the ovaries or tumors can be readily performed. This procedure isolates the tubes from the other pelvic viscera and makes them available for coagulation or ligation as a method of sterilization.

Fig. 4. Trochar and cannula for puncturing the posterior vaginal wall.

Indications for Examination. The indications are: (1) Primary and secondary sterility in which the usual examinations do not give all the information desired; (2) small ovarian disease in which vaginal palpation is inconclusive; (3) differential diagnosis of ruptured follicle or corpus lutem cysts from ruptured ectopic pregnancy; (4) suspected unruptured ectopic gestation; (5) study and effect of the gonadatropians upon the ovary, and (6) endometriosis.

Contraindications for Examination. These are: (1) Adherent uterine retrodisplacement with fixed masses in the cul-de-sac; (2) so-called frozen pelvis; (3) acute and subacute pelvic inflammatory disease; (4) cardiac decompensation in which the assumption of the knee-chest position is unsafe, and (5) when puncture of the cul-de-sac in the knee-chest position does not result in an inrush of air.

All patients examined to date have been admitted to the hospital overnight. After one has become familiar with the technic it is believed that in properly selected cases the procedure can be utilized at the office or clinic.

Our experience in over forty cases of culdoscopic examination has brought the authors to the conclusion that this examination is an invaluable asset in the study of obscure pelvic disorders. The procedure gives definite and detailed information concerning the pelvic organs that is not obtainable by any other procedure but laparotomy. The procedure is safe; no mortality or complications have been observed to date.

Fig. 5. The Decker culdoscope.

Culdoscopy has many advantages over the abdominal approach. The examination made by way of the cul-de-sac is less painful and the visualization is complete. Other tests can be performed at the same time without changing the posture of the patient, such as tests for tubal patency by the injection of fluid through the cervix. The psychic aversion to abdominal puncture is avoided. We have found that patients readily submit to the examination and to repeated examinations.

SUMMARY

A new procedure for pelvic visualization termed culdoscopy is described.

Culdoscopy is found superior to peritonescopy in the diagnosis of pelvic disease and the study of physiology.

The procedure is invaluable in the investigation of pelvic tumors, small ovarian disease, endometriosis, ectopic pregnancy and especially helpful in the detailed study of primary and secondary sterility in females.

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Cysts of the breast are usually due to blockage of the secreting mechanism, either by fibrosis from without or obstruction from within the lumen.

From "A Short Practice of Surgery," by Hamilton Bailey and R. J. McNeill Love (H. K. Lewis & Co. Ltd.).

PELVIC REACTIONS TO INFECTIONS

A STUDY OF 493 OPERATIVE CASES

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THESE 493 patients were operated upon in our Cook County Hospital Clinic during a period in which the conservative treatment, having had its incipiency, came into more general use. The results obtained in this series of cases went far to establish the fact that most reactions to infections could be depended upon to overcome the infection, but that the reactions, even though the infections had subsided, left adhesions, thickened tissues, masses large and small, which produced pain and interfered with the function of organs, and were often the site of returning activity by reason of dormant foci or reinfections, so that in the interest of health, operation became necessary.

It should be understood, also, that many cases were so related to sources of infection that a quiet period never resulted in the entire absence of activity.

We must not consider the reactions as primarily an enemy of the host, for they represent the forces by which the infection is overcome, after which they remain as health-destroying structures and may lead to fatal results. Usually, however, such results are connected with reinfections.

Perhaps this clinical material will have added value if we visualize the conditions under which they come. This is a charity clinic which receives women of all ages, colors and nationalities. It goes without saying that the majority are poor and many have always been destitute; many have seen better days; some in fair circumstances come because they do not feel able to stand the expense of a long sickness; some come to beat the County, and some come thinking that there they meet better specialized care than they could select outside; but most important, many come because their present condition demands and is driving them to seek hospital care. Only a moderate number come because they elect an operation and are ready for it. Most of these patients then have come at the height of an attack, or because a moderate attack has furnished an urge to remember previous attacks.

It is probable that no like sized group of cases show the average of severity and complications, except in a like charity clinic. Very few come presenting conditions ready for operation. Patients that come with normal or very slight temperature, who need only a few days to get the field of operation clean, and heart, bowels and kidneys functioning well, are rather the exception, and represent more the general run of private cases. The more usual run come with active conditions requiring one week to ten days to reach a normal temperature and relieve disturbances of circulation, and to get the bowels and kidneys functioning well. Deflation of all distended structures is required. There is a large, but lesser number, who come with conditions so active and so neglected that two to three weeks are required to reach conditions which make them safe risks.

A moderate number come in which a preliminary cul-de-sac drainage is necessary to save life and prepare for a clean-up operation. A few come with pus pockets and foci of infection so numerous and sepsis so severe, that after a long effort at preparation, the risk has to be taken to bring to an end a dangerous activity; lastly, some patients, reaching a quiet

period, have become so reduced in strength that they should have a long period of recuperation and rebuilding before being subjected to so severe an operation as their condition requires. Rest, fluids, plasma, transfusions and tonics are desirable over a long period. Not only will these patients stand an operation better because of this long period of rest, but the local tissues will have improved so as to make the operation a lesser attack upon the vital forces of the patient.

A typical picture in extreme cases upon entrance is: a patient very sick, anorexia, vomiting, marked distention, lack of bowel action, bladder disturbances and abdominal distress directed toward the lower abdomen; temperature 102° to 104°F.; pulse 100 to 140; pus exuding from vagina, scalded vaginal mucosa, uterus fixed or uterus and greatly enlarged adnexia "frozen," all appearing as one mass, fixed to bony pelvis and in many cases including the lower abdominal wall. Such a mass chokes the bladder, the rectum, and involves the sigmoid and loops of small bowels; the ureters are choked and the urinary stream is compressed, embarrassing kidney function, and the circulation of all organs is hampered. Marked tenderness is present and one structure cannot well be distinguished from another. All degrees of involvement are encountered from this, upward to severe bowel ileus and general peritoneal infection, infection of the blood stream, local and distant pus deposits down to very moderate tubal involvements in an inactive stage.

The so-called "hot" cases were once thought to require immediate operation and so furnished a large part of the mortality and morbidity following surgical treatment of this class of cases. It has now been proved that most of these cases may be guided through the active stage and brought to a safe surgical period. It will be seen then that to attain a low surgical mortality, an important preliminary treatment must be carried out. These results must be attained: the bowels, kidneys, bladder, ureters and circulation should function well. Tenderness and swelling should largely disappear. The abdomen should become flat. The pelvic "frozen" mass should present to a certain extent its component parts. The temperature should reach and maintain a normal level—in mild cases four to five days, in moderate cases one to two weeks, and in severe cases a longer time. The pulse should approach normal; the leucocyte count should be as low as 10,000.

We have not derived much help from the sedimentation test in determining the best time for operation. All patients in preparation for an operation should remain in bed. Getting up and around at the first evidence of improvement brings about an exacerbation of symptoms, delays the period of safe operation, prolongs the stay in the hospital, and defeats the purpose of rest and preparatory treatment.

The preparatory treatment should include sedative enough to quiet pain and induce sleep and the lessening of tension with hot douches and hot stupes. Bowel activity may be encouraged by mild enemas; cathartics should be avoided. The Levine tube is very helpful. At times good results are gotten with the Miller-Abbott tube. Fluids may be given intravenously until tolerated by the intestinal tract to flush the kidneys and to counteract acidosis. This line of treatment usually results in a marked drop in the temperature, pulse and respiration curves, and in a return of feeling of well being. The choked condition of the pelvis disappears and not only the patient, but the local tissues, are in better condition for operation.

Restlessness and nostalgia lead these patients to a desire for action; they want to have the operation performed or be allowed to go home. If they have the operation too soon, it will show in mortality and morbidity results. If the preparatory treatment is delayed too long, they will go home in many cases. If they would go home, live quietly and return at the proper

time, this would often be desirable, but these patients are not governed by judgment and they would return only when another acute attack has overtaken them. This means that in many cases the picking a time of a fairly safe operation before they are quite improved enough to take up their duties at home is important. It is apparent that patients entering the hospital in an active stage of infection will not be bacteria-free when they reach a quiet stage, and this is well shown by the study which was made by Dr. Lash. Rather must we assume that the bacteria have become dormant and are for the time being controlled by the immunity which has developed in the patient.

While further improvement might be desired, the patients' interests are not best served by their going home to another attack, and should not be risked if they present a fairly good condition for operation.

Following a consideration and analysis of the 493 cases, we will detail a plan of attack for the severe ones, that will simplify matters for the operator and be life-saving for the patient.

An analysis of the histories of the 493 patients gives the statistics shown in Table 1. Acute venereal infections, lacking gross pelvic reactions, were sent in the distribution to the Venereal Clinic. Some borderline patients that seemed to be having a primary attack without masses have been referred home for possible recovery. This has been followed by a large percentage of returns. At present better results might be obtained with free use of sulfonamides.

Race. In commenting on the etiological factors, although 58.4 per cent of the women were white in this series, it may be said that pelvic infections whether venereal, puerperal or other type, reveal no racial preference.

TABLE I

STATISTICS OF 493 OPERATIVE PATIENTS

Race	No.	Age in Years	No.	Civil State	Pregnancies (Full Term)	Puerperal Fever	Abortions
White.....	288	15–20	112	Married 333	0—267	10	152
		21–25	173	.....	I—131		
		26–30	103	Single 90	II— 40		
Black.....	205	31–35	54	.....	III— 27		
		36–40	38	Widow 70	IV— 14		
		41–45	6	.....	V— 5		
		46–50	6	.....	VI— 2		
		57	1	.....	VII— 2		
					VIII— 2		
					IX— 2		
					XI— 1		

Age. The range of age was from fifteen to fifty-seven years, with the majority of the patients, 78.7 per cent, being below thirty.

Civil State. The fact is that 81.7 per cent were married. Thus pregnancy, abortions, spontaneous or induced, and puerperal infections play an important rôle in the causation of pelvic infections, although venereal infections are not excluded by marriage.

Obstetrical History. The incidence of women unable to carry a child to term or become pregnant was high, and as one would expect in such a series, nullipara were in the majority. Also after the first full term pregnancy the occurrence of subsequent ones was uncommon. Thus 26.5 per cent of the patients had one full term pregnancy while only 8.3 per cent had two full term pregnancies, and

the number of women having more than two was even smaller. It is, therefore, observed what an important part pelvic infections played as the cause of sterility, although one must not overlook syphilis.

TABLE II
BACTERIOLOGY OF GROSSLY PATHOLOGICAL FALLOPIAN TUBES IN 100 PATIENTS

Streptococcus	38	Hemolytic	14
		Viridans	21
		Indifferent	3
Gonococcus	4		
Bacillus coli	13		
Staphylococcus	33		
Micrococcus tetrageuus	1		
Bacillus diphtheroids	3		
Bacillus proteus	3		
Bacillus capsulatus	4		
Pneumococcus	2		
Cultures in 20, sterile			

Bacteriology. The results of the bacteriological study of the grossly pathological Fallopian tubes removed from 100 patients are given in Table II. The streptococcus is the predominating organism, occurring in 38 per cent of the cases, alone or with other organisms, and being of the hemolytic type in 14 per cent. The streptococci were studied especially because of their frequency. Based upon morphological, cultural, biochemical and pathogenic characteristics observed, they were found to be similar to the strains from the different fatal streptococcic infections, as in septicemia and general peritoneal infections. These findings should be borne in mind as they support the principles laid down for treatment.

Pathology. Bilateral salpingitis occurred in 249 cases, unilateral in eighty. Both ovaries were involved in ninety-two instances, in one of which there was a complete sclerosis with resulting amenorrhea; in 193 patients only one ovary was involved. There were 110 bilateral pyosalpinges and fifty-one unilateral. In only eight cases was there a pelvic abscess. The associated pathology was as follows: Retrodisplacement ninety, relaxed pelvic floor thirty-seven, cystocele fourteen, rectocele sixteen, old lacerated cervix nineteen, fibroids thirty, erosion of the cervix eight, mucocele of cervix one, metritis thirty-seven, prolapsed uterus three, Bartholinian cyst three, Bartholinian abscess two, retained placenta of two years standing one, acute epiploitis three, cyst of rectum one, parovarian cyst one, dermoid cyst one, teratoma one, lacerated sphincter ani one, bicorimate uterus one, ruptured ectopic pregnancy one, and cordate pregnant uterus one.

The listing of the pathological conditions can hardly describe the pelvic conditions found at operation: the wide range of involvement, from the thickening and binding down of one tube to the marked state of conglomeration of uterus, large and boggy, of Fallopian tubes, distended with pus and thickened, of ovaries, cyst or abscess containing, of friable rectum, of thickened sigmoid, cecum or small intestine and of omentum, all bound together into a solid mass, the so-called frozen pelvis. The degree of involvement of the peritoneum with healing was remarkable. The ability of the pelvic peritoneum to localize and overcome infections is due to the relative non-activity of the pelvic viscera as compared with those of the abdomen and to the probable immunization of the patient. This quiet state is disturbed at the menses, by work or exercise and pregnancy where possible. Although organisms cannot be found in the blood in the acute stage, immunization is probably actively produced by the toxin from the causative organisms, especially the streptococci. This assumption is based on the probable similarity of streptococci, as those of puerperal fever, scarlet fever and erysipelas have been found to produce toxin. Therefore, the bacteriology and pathology of these infections definitely establish the fact that surgery is not necessary but harmful in the acute stage. However, when the normally mobile organs such as the intestines, omentum and sigmoid are immobilized by adhesions or pus containing tubes or ovaries are present, surgery is demanded after the acute stage has subsided. The tubes and ovaries containing pus may not only be foci of

infection or of chronic toxemia, but also the cause of amyloidosis of the parenchymatous organs.

Symptomatology. The clinical course of these pelvic infections is quite characteristic. The general systemic condition depends on the degree of disturbance of digestion and of rest. Locally, pain in one or both iliac fossa was constant occurring in 451 patients. It varied from a dull, aching, annoying discomfort, aggravated by exertion to a sharp, cramping or lancinating pain. The involvement of the intestines and omentum was probably the chief cause of the pain. Backache, though considered common was present in only ninety instances. Leucorrhea was present in almost all cases, although the amount sufficient to attract the patient's attention was proportional to the degree of personal hygiene. It was noted in only 283 patients. Burning on urination was complained of by only seventy-eight. The incidence of menstrual disturbances was as follows: menorrhagia 121, metrorrhagia twenty-one, dysmenorrhea 108, and irregularity in time interval thirty-six. Temperature rarely rose above 103°F. and was more commonly absent. The pulse was usually within normal limits increasing when the process extended or an abscess was present. The leucocyte count ranged from 6,000 to 31,000 but in all cases before operation was below 10,000.

The duration of the symptoms varied from months to years. The usual course consisted of a series of attacks, lasting from a few days to two or three weeks, with irregular intervals between. Of the 493 patients, 204 had one or more previous attacks.

With the characteristic history and findings no difficulty was experienced in diagnosing the condition, but the atypical clinical findings may be confusing. Thus in a unilateral involvement with a menstrual irregularity, ectopic pregnancy may be considered, especially in the unruptured state and only by observation and sometimes only by laparotomy will one be able to differentiate the two. Fibroids of the uterus may be simulated. In the streptococcal infections, especially the postabortive type, a hard fixity of the pelvis may be produced so that carcinoma of the uterus with extension will be so strongly suggested that laparotomy is considered only as a confirmatory measure when the true condition is recognized. Sampson's cysts or endometriomas of the ovaries may also produce pelvic conditions resembling inflammatory processes.

Treatment. Before going on to the surgical treatment one may make mention of those that have been offered as substitutes. Cherry has recently reported that foreign protein therapy is of no value. The reaction required to produce a change in the pelvic condition was dangerous to the life of the patient. However, Gellhorn's report cannot be ignored and in certain types of cases palliative results may be obtained. As to diathermy, Cherry found it of value in the gonorrheal infections, but dangerous in the postabortive type, having had one death and one abscess formation resulting from the procedure. The streptococcus being a common primary or secondary invader, diathermy should be considered only with caution if at all. Since the effect of the diathermy is only to decrease the size of the pelvic inflammatory mass and relieve the patient of symptoms, the question arises as to its ability to free the bowels or omentum or to restore the uterus to its normal position. But here again, these non-surgical measures are aimed against the infection and as has been stated before, rest and non-interference will achieve all that is possible, although diathermy with care can be used as a palliative measure. For emphasis, it may be reiterated that surgery is of value not to treat the infection but the permanent reactions to the infection. These end results requiring surgery are intestinal involvement, malposition of the uterus and adnexal masses, all producing symptoms, and are unaffected by medical procedures for any length of time.

The decision having been reached that only surgery can be of aid to the patient, the determination of the proper time for operation is next considered. The condition of the patient that indicates the optimum time for the operation is reached when the acute exacerbation or the acute superimposed infection is localized or healed and immunity has been induced. No better guide have we of judging this desired state than temperature, leucocyte count and degree of tenderness in the iliac fossae. Neither Schmitz nor Cherry found the sedimentation test superior to the methods mentioned. From experience it has been observed that when the temperature and leucocyte count remain within normal bounds for five to seven days the patient is usually ready. But in the puerperal type a wait of several months is preferred if the patient can be controlled; at the Cook County Hospital such ideal circumstances are not present. In the group analyzed the preoperative or preparatory interval varied from one to fifty-one days in the hospital.

The surgical procedure carried out is controlled by the pathological condition present; that is, each patient requires individual consideration. The pathological state should be a greater guide to the gynecologist than the social status of the patient. However, in young women who make up the majority of the patients (78.7 per cent) a conscientious effort must be made to conserve as much ovarian and endometrial tissue as possible. This effort should be made even at the risk of requiring a future operation. It is not because of mere sentimentalism that this is advocated. That women have a more unstable mental balance is common knowledge. The depression and fear of abnormality instilled by the absence of the normal function of menstruating can leave a definite ill effect on a woman, so that all that was gained by preventing physical invalidism is lost by the appearance of mental unsatisfaction.

In the 493 patients, the following necessary operations were performed: salpingectomy, bilateral 418, unilateral seventy-five, cophorectomy, bilateral 134, unilateral 263, partial resection of remaining one, twenty-seven, hysterectomy, abdominal, total forty-three, subtotal sixty-eight, vaginal total one, defundation twenty, amputation of the cervix fifteen, trachelorrhaphy forty, dilatation and curettage fifty-one, round ligament shortening 122, appendectomy 285, repair of ileum five, one of which required resection and anastomosis with the sigmoid; ileostomy one, partial ligation of the omentum two, anterior colporrhaphy twenty-one, perineorrhaphy sixty-three, posterior colpotomy twelve, drainage eighty-two, secondary abdominal suture one; excision of Bartholin's gland four, excision of urethral caruncle one, excision of cervical mucocele one, and repair of sphincter ani one.

The above statistics show that eighty-four per cent of the patients required both tubes to be removed, as conservation was impossible. On the other hand only 27.2 per cent of the patients lost both ovaries, while in 72 per cent some ovarian tissue remained, varying from a part of one to both. The incidence of hysterectomies (all types) was 22.7 per cent and of defundation 4 per cent. Some uteri, while not entirely normal, were allowed to remain as they usually heal after the essential disorder is removed. Only one vaginal hysterectomy was performed. This hardly needs discussion for in the presence of a conglomeration of adherent pelvic and adjoining organs, vaginal hysterectomy has no large field. Drainage was carried out in only 16.6 per cent of the cases, being dependent upon the degree of oozing produced and of exudate found.

The postoperative course was uneventful in 85.6 per cent of the patients, for that number left the hospital before or by the nineteenth day. After this time the number of patients decreased as the postoperative period increased. The longest periods were, one sixty-seven days because of the phlegmosia alba dolens and the second eighty-four days due to an intestino-abdominal

fistula, pulmonary tuberculosis and chronic nephritis.

The morbidity incident to the operations was, pyelitis one, cystitis three, wound infections thirty-five, perineal abscesses one, phlegmosia alba dolens three, intestino-abdominal fistula two, postoperative bronchopneumonia one, and an aggravation of a cardiopathic condition in one case. It is interesting to note that one patient who had a psychosis before operation became normal after it.

Of the 493 patients operated upon, seven died, giving a mortality of 1.42 per cent. The causes of death were as follows: (1) Generalized gangrenous fibrinous peritonitis with perforation of the rectum, death on the fourth postoperative day; (2) postoperative ileus, died on the fourth day; (3) acute dilatation of the stomach, died on the second day, no autopsy; (4) postoperative shock, died ten hours after operation; (5) acute epiglottitis and generalized peritonitis, died on the tenth day; (6) cardiac failure on the tenth day, no postmortem; (7) generalized peritoneal infection and edema of the lungs, died on the twenty-third day postoperatively.

PLAN OF OPERATION

The patient should have had a normal temperature for several days in the less complicated cases, to two to three weeks in severe cases, to many weeks in the exceptionally severe cases. There should be a corresponding normalcy of the pulse and leucocyte count, and all vital functions acting well. A dried out condition should be overcome by fluids by mouth, salines and glucose by rectum, and perhaps glucose intravenously. Any considerable anemia may be overcome by preoperative transfusion, which may be required in some cases with long continued sepsis and in cases complicated by fibroids with hemorrhage. Chemotherapy has been found helpful in some cases, preoperatively as well as postoperatively.

In some few cases with moderate reactions to infection involving the uterus and adnexia, special conditions may make it desirable to choose a vaginal operation, but the large number of cases will be served best by an abdominal operation.

The operator should have a plan. The less experienced the operator, the more necessary the plan. Examination may indicate that the total mass fills the lower part of the abdomen. When the patient was examined upon entering the hospital, this was recognized as a conglomerate mass with individual structures little recognized, but now one structure begins to be differentiated, at least slightly, from another. Bimanual examination may be instructive, but where palpation fails, our sixth sense should penetrate the mass and recognize it as made up of several layers of organized structures, some of which must be left and some of which are to be removed.

1. At the back and sides is the bony pelvis, usually not much affected, although infection may have penetrated the acetabulum, and the sacro-iliac joints may be involved.

2. Lining the pelvis and covering the ureters, blood vessels, muscles and connective tissue, is the peritoneum, which may be little involved or may be penetrated by infections and the protected structures seriously involved.

3. More or less movable structures, but now fixed, are the tubes, ovaries, with perhaps cysts, and the uterus, with perhaps fibroids. Abscesses may be found in any of these structures, or between them and surrounding structures. The tubes and ovaries may be in contact in front of the rectum, or the much involved appendix may lie in the median line between the pus tubes, or the pus tubes may grasp the rectum at the sides, or the pus tubes may encircle the rectum, absorbing the rectal mesentery. The tubes may be adherent in the cul-de-sac or be lifted up and adherent to the uterus, or shoved forward and be adherent to the bladder, the uterus being retroverted and flexed and adherent to the cul-de-sac or rectum. Any structure lying in contact with the tube may become

adherent to it and in time, an exit channel may form through the adherent walls. One tube may burrow the peritoneum so that it contacts the ureter and a uretro tubal fistula may form.

4. A layer of sigmoid, and small bowels, cecum and appendix may become adherent over the uterus and tubes. The bladder may furnish the anterior part of this layer.

5. The omentum may be disposed over the previous layer and become thickened and form a cast-like layer.

6. Outside the above layer and perhaps extensively adherent to it is the abdominal wall, complete in its layers if no previous operation has been done. Perhaps a previous operation has been far from complete, and in this latter case, a bowel knuckle or a larger surface may be adherent to the scar. The abdominal wall may be so infiltrated that to feel, it seems a part of the conglomerate mass; but this mass should be rendered into these different component layers, some of which are to be left and some of which we aim to remove.

We now take a complicated case. If this method is worth while in the worst cases, it will work in the less complicated.

We have visualized the condition; we have laid our plan. We do not know where or when we will encounter pus pockets or open viscera. We must be ready and not be caught short, either materially or mentally. In order to clear the field and not let pent up infection be distributed, a working suction apparatus should be at hand.

The first layer—the abdominal wall—must be opened and separated from adherent structures. Theoretically, this should be the omentum, but in case of operative scars it may be loops of bowels. The omentum may be irregular. To avoid an adherent bowel or a displaced bladder, the peritoneum should first be opened at the upper end of the incision where nothing is adherent. The incision should be carried low to facilitate the pelvic approach. In old scars, progress downward should be made with great caution; what seems to be an adhesion may be a stretched out knuckle of bowel and may inadvertently be opened. The abdominal wall layer should be separated from the layer below, from above downward. In these badly complicated cases carrying dormant or pocketed infection, there is much to be said against generalized exploration of the abdomen with the hand; but if for any reason it seems desirable to palpate the upper abdomen, this is the safest time to do so, not delaying it until all infected tissues and bacteria carrying pockets have been exposed.

The omentum in case of no previous operation may be evenly and symmetrically distributed and should be approached from below, and carefully detached from below upward, and displaced upward, and held out of the way with moist gauze pads. In case of a previous operation the omentum will be more unevenly distributed and perhaps there will be more low adhesions. The separation from the abdominal scar may leave a hole in the anterior omental layer. Separated fingers of omentum may run here and there to attachments where they have been most needed and may have to be tied off before they can be displaced upward out of the way. This fingering to certain needed areas may not be entirely absent in the absence of previous operation, but it is accomplished with more intactness.

With the abdominal wall and omentum out of the way the mass has become less in size, yet nothing has been removed. The next layer may be so complete that the uterus or tubes are not yet seen, or this layer, composed of sigmoid, cecum, small bowels and perhaps the bladder, may be incomplete, leaving the uterus and perhaps the tubes exposed. Practically all of this layer is to be preserved, and with its changed pathological state should be approached with great care, lest bowels be injured or separated from their mesenteric attachments. Lines of cleavage should be sought and carefully followed. Any attachment of small bowel should be carefully

separated from below upward—their mesenteries would be on the upper side, and any effort from above downward might easily detach the bowel from its blood supply. Next the sigmoid should be separated carefully from below and forward, in a backward and upward direction. The cecum and appendix should, if disposed over the uterus and tubes, receive like treatment. The bladder, if adherent, should be worked off from backward toward the front. This may have to be started by incising a binding adhesion. This has again greatly reduced the size of the tumor by freeing the mass of structure which is to be saved. In working at these masses which have attached themselves to the tubes, ovaries and uterus, it is quite possible to consider them a part of the mass to be removed and with the hand above the mass, tear the sigmoid from its mesentery. The line of cleavage must be sought as stated and the bowel worked off from before backward.

We have come now to the real mass which in severe cases is likely to need removing. As compared with the original mass, it may be very moderate in size. In some cases of even large pus tubes, the uterus and an ovary or a part of an ovary may be left. The uterus may contain a fibroid. With or without this, the uterus and tubes may be impacted and not easy to remove from the pelvic cavity. Pressed hard against the bony pelvis wall are the ureters, vessels, nerves, rectum and bladder, all of which should be left uninjured and disturbed as little as possible. A moderate, careful effort may be made to insinuate the hand between the pelvic wall and the mass. This will be facilitated by traction upon the uterus with a strong forceps. If this is not successful, consideration of the fifth layer, which is to be left intact, calls for a bisection of the uterine mass, or the removal of a wedge-shaped piece, or a core of the uterus. With the uterus and tubes out of the pelvis, stripped of all attachments, a really complicated case may present as clean cut a case for a four point clamp and tie hysterectomy as an uncomplicated case. If there have been unavoidable holes left in the bladder, ureter, rectum, sigmoid or ielum, any of which have at times occurred, we proceed to their repair if available tissue is present.

Drainage through the vagina was done when drainage was thought necessary, but in later years a stab wound outside the rectus has been used with greater satisfaction. Drainage is considered in these conditions: (1) evidence of weakness in bowel wall with poor repair tissue, putting drain near, but not at the weak place; (2) deep oozing not readily controlled; and (3) considerable evidence of active infection.

We believe that less harm is done by a cigarette drain removed early if not found necessary, than by an infection becoming active without drainage.

We believe that the plan of reducing these large complicated masses to their component parts, rather than haphazardly seeking a place to put the next suture, has been an important factor in the reduction of mortality and morbidity.

No one feature of the after-treatment had a more salutary effect than the installation of a separate recovery room where the later methods could be carried out. The mortality and morbidity records could easily have been lowered if the first half of these cases had had the advantages of the latter half; and if none of them had lacked the benefits of blood, blood plasma and glucose intravenously, a better showing might have been made; but these cases were without the means to draw extensively on these helps. However, when we review the 493 patients, many of them in desperate condition upon entrance, a mortality as low as 1.42 per cent seems not unreasonably high. A glance at the causes of death in the seven cases would seem to indicate that some of these might have been saved; but when we remember that only seven patients died, it will be seen that patients in this series were not

allowed to die without active measures having been used to save them.

SUMMARY

In a series of 493 operative patients who had partially arrested pelvic infections with gross pathological conditions of the pelvic organs, the etiological factors were in addition to the ever possible gonococci, abortions and the puerperium with their concomitant injuries which served as atria for the pyogenic organisms. As to age incidence 78.7 per cent of the women were below thirty and nullipara predominated. From the bacteriological study of 100 cases streptococci were found to be the predominating organism. The pathological states showed a wide variation of involvement. The clinical course was fairly characteristic while the atypical cases required differentiation from simulating conditions such as ectopic pregnancy, fibroids, endometrioma and carcinoma of the uterus. Surgical treatment is considered only when permanent end changes occur in the pelvic structures resulting from infections. In the choice of operation, there was a distinct leaning toward conservatism. The important steps in surgical treatment are proper preparation of the patient, proper election of time of operation and rational conservation of tissue. The mortality rate is 1.42 per cent in this group analyzed.

CONCLUSIONS

From the analysis of a large number (493) of patients operated because of pelvic disorders unresponsive to medical measures, and from the bacteriological and pathological examination of the Fallopian tubes removed, it is concluded that:

1. Though the gonococci may be common primary and secondary invaders, pyogenic organisms play the chief rôle in permanently destroying the female pelvic organs.

2. In these conditions methods of treatment other than surgical are at best palliative only.

3. As the pyogenic organisms are so commonly found in the tissues, especially the streptococci, due time must elapse between the last acute exacerbation and the operation to allow immunization of the patient. Though the dormant bacteria were found to be virulent yet were avirulent in the presence of the active antibodies of the patient.

4. The best guides at present for determining the proper time to operate are temperature, leucocyte curve and the degree of tenderness in the lower part of the abdomen.

5. The above principles have a firm basis as they were followed in the treatment of the described series of patients with the resulting mortality of 1.42 per cent which is the lowest in the reported literature.

6. The method of dealing with conglomerated masses as detailed in the *plan of operation* we feel sure had much to do with a low mortality.

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TOPICAL APPLICATION OF HORSE SERUM IN THE TREATMENT OF EXTENSIVE BURNS

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WHILE the increased incidence of burns in civil life has attracted considerable attention mainly because of the fire hazards resulting from overcrowding and the apparent nature of the materiel used in the manufacture of ammunition and allied inflammable products, the ever increasing potential hazards encountered in combat by sea, air and highly mechanized land warfare have given added impetus to a critical study of the management of burns in our armed forces and in all theatres of warfare throughout the globe. It is not the intention of this paper to review the multiplicity and diversified views expressed on the subject of the management of burns but rather to take into consideration all of the newer concepts of the disturbed physiology resultant from burns and to crystallize a simple, adequate, applicable form of treatment which could be utilized under conditions of the various exigencies of combat as well as civil emergencies. Obviously, treatment which is based upon silencing the source of the trigger mechanism mediating the remote disturbed physiology in burns and combating the latter with appropriate measures is most desirable.

In 1923, one of us (H. M. R.) in charge of several extensive burns, made the observation that the excessive blood plasma the body pours out over a burned skin area several days after the original burn, does not jell or coagulate readily under the heat of an electric bulb, which was then being used in the local treatment of burns. Moreover, the local application of horse serum to the burned area yielded an adequate jelling of the plasma under the heat of the same electric bulb. Since serum does not contain fibrinogen, it was pointed out that a substance other than fibrinogen was responsible for the adequate jelling or coagulation of the plasma in the burned area. Based on this phenomenon, it was believed at the time that the local application of horse serum tended to act as a physiological plug to excessive plasma loss in addition to the healing and bactericidal properties of serum and plasma.

Based on this concept for upwards of fifteen years the topical application of normal horse serum was used in severe burns. A review of the literature revealed a case report by Robinson[1] in 1917 and later reported by Montieth and Clock.[2] In our series, freedom from pain, toxemia, and the low incidence of severe dehydration was an outstanding feature in all the cases regardless of the degree of burn. This of course excludes those patients who made an exitus in the first few hours after admission. By far the most gratifying observation was the perfect epithelization (Figs. 1 and 2) of the burned area, which obviated the necessity for skin grafting. It is because of these facts that it was believed the collected fifty-two cases deserved reporting particularly at this time in the face of the expectant burn hazards of highly mechanized warfare.

The method of treatment of severe burns consists of the following steps:

1. Treatment of burn shock: It is this stage that has received the most attention in the literature during the past few years. Although transfusions were used generously in the early years of this method of treatment, it is conceivable that the results would have been further improved

if plasma[3] transfusions and adrenal cortex extract[4] were available.

2. Breaking of the blebs, if readily accessible, with sterile scissors.

A B

Fig. 1. A, anterior view; B, posterior view. J. P., age seventy, male, third degree flame burn of right forearm, hand and fingers, extent of lesion self-explanatory. Treated with human plasma by spray for six days and thereafter with horse serum.

3. No washing of the burn unless grossly contaminated and no débridement.

4. Spraying of the burn with normal horse serum, with a non-metallic atomizer, at first every hour, then at longer intervals. A small heat lamp is played over the area until the serum and plasma are coagulated.

5. After about ten days to two weeks, the burned part is soaked in sterile saline, and as the eschar separates, spraying and saline washings are repeated until complete epithelization takes place.

Fifty-two patients with severe burns of second and third degree were treated in this manner. Eight patients in whom more than 75 per cent of the body surface was involved did not recover and died within a few hours. This is a common finding with all accepted treatments. In the recovered cases, the rate and extent of healing seemed to us to be remarkably fast. The absence of infection and pain was most outstanding. The healed burns exhibited little or no scarring and contractures commonly due to burns were not in evidence. In only one case was there evidence of a reaction due to the medication, and that was a case of mild serm sickness (hives) in a severe burn. This reaction required no treatment. In spite of the splendid results of the therapy, individual treatment of a patient is still important. The active and passive motion are necessary especially in the neighborhood of joints. Figures 1 to 12 are self-explanatory and are typical of all the cases. The shaded areas represent second and third degree burns of the skin, and the treatment given is abstracted in the legend beneath each figure.

EXPERIMENT

Since it is virtually impossible to compare accurately the healing time of burns in actual patients, because of difference of

the extent of the burn, differences in the time before institution of treatment, and differences in the resistance of the individual, one of us (L. P.) sought for a laboratory method whereby we could control these variables.

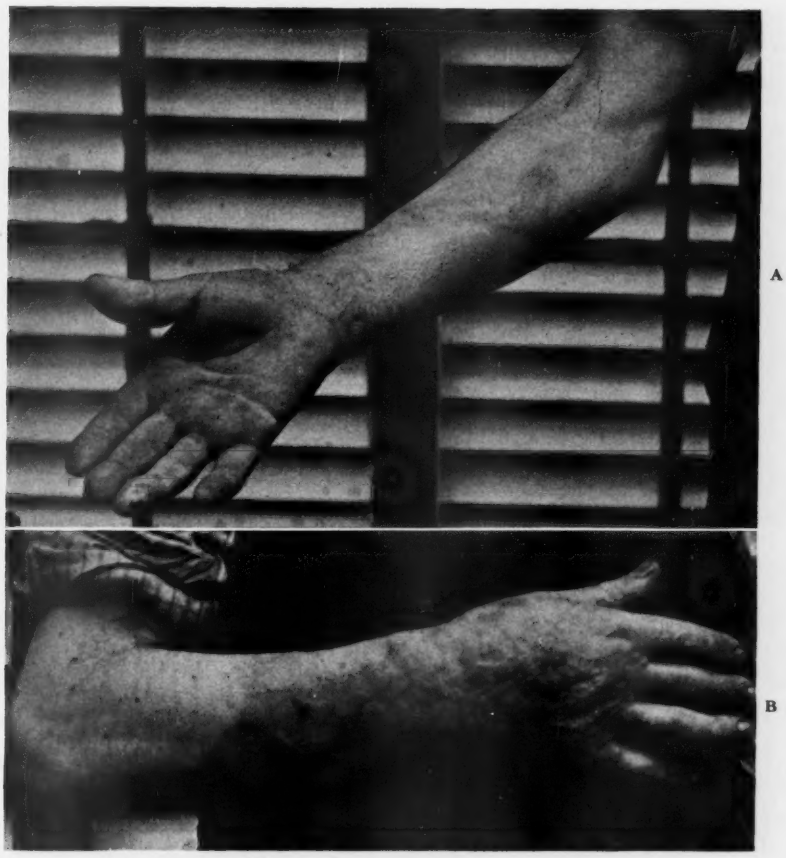

Fig. 2. Same case as in Figure 1. A, anterior view; B, posterior view. Complete epithelization without gross scarring in forty-eight days. Active and passive motion was started in ten days.

Fifteen adult rats of approximately 175 Gm. in weight were used. An area of 2½ cm. square on the lateral body wall was clipped free of hair and burned with an electrically heated cautery iron under anesthesia. The iron was moved around continuously so as to get a fairly even burned area. In each case, the burn approximated a third degree burn. According to plan the following medicaments were immediately applied.

Group I: Five rats were sprayed with normal horse serum containing 0.30 per cent cresol.

Group II: Five rats were sprayed with tannic acid.

Group III: Five rats were swabbed with silver nitrate and then sprayed with tannic acid.

The rats were treated in this way three times on the day of injury and once each day on two ensuing days. The animals were observed each day. None of the rats died of the burns, and none gave any indication of pain following application of the medicaments. At the end of one week, the healing was appraised, the animals were sacrificed by anesthetization with ether, and full thicknesses of the burned skin were taken for gross and microscopic examination.

The differences in the groups of rats were marked. In the serum-treated rats at the end of one week, there were no

evidences of infection; there were attempts at healing; in several cases there were evidences of partial epithelization of the

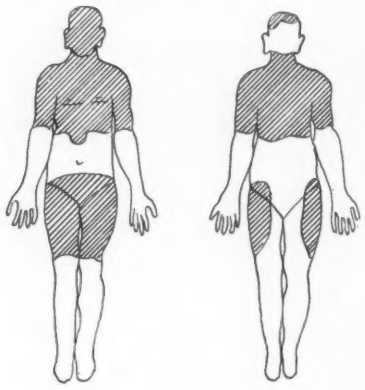

Fig. 3.

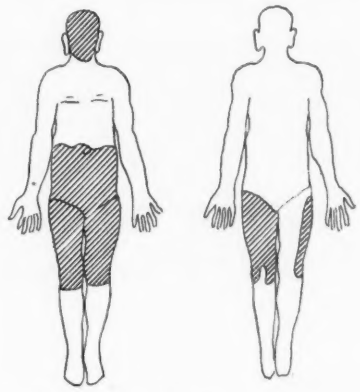

Fig. 4.

Fig. 3. Case xi. J. L., age twenty-four, male. Steam burn in Turkish bath. Ran septic course from the fourth to the thirteenth day and then improved. Had 500 cc. of blood on ninth day. Burn healed without scarring in thirty-two days.

Fig. 4. Case xiv. L. F., age four, male. Hot water burn. Received 200 cc. of blood. Horse serum applied for seven days, then saline dressings. Healed in nineteen days without scars or contractures.

burned surfaces. The crusts on these surfaces were soft and pliable. In the tannic acid-treated rats, the burned areas were covered with a heavy, unyielding tan under which there were invariable evidences of suppuration. In the group of silver nitrate and tannic acid-treated rats, the coagula were thicker and heavier than that of the previous group. Otherwise the findings were essentially the same.

The burned areas were then examined for pliability. The serum-treated wounds were extremely yielding and soft, while the tannic acid-treated wounds, and the heavily tanned wound of the tannic and silver nitrate group were stiff and not pliable. The microscopic sections made from these wounds showed comparable changes. However, these sections showed that it was impossible to burn the animals so that the exact microscopic layers were involved similarly in each case.

Comment. For many years, the tanning[5] treatment of severe burns has held the spotlight. While this treatment was without doubt an improvement over the methods that were used previously, it has always appeared lacking when viewed from a physiologic basis. Recently, there appeared two divergent schools of thought on this subject. One group recommended other coagulating substances to be used along with the tannic acid, so as to get a thicker, heavier and, therefore, more unyielding tan.[6] Another, led by the emminent C. P. G. Wakeley,[7] has caused us to believe that the tannic acid treatment of burns is associated with an amazingly high mortality. Certainly it is true that war burns, due to the fact that they are predominantly face and hand burns, are not particularly suited to the prolonged splinting of an unyielding tan because of the danger of contractures. A heavy leather covering would, *a priori*, seem to be an unphysiological environment for the growth of the delicate new skin cells and would, therefore, necessitate much skin grafting. That this is a fact is common knowledge. Recently, several workers[8] experimentally produced necrosis of liver cells in the central portion of the lobule, by injecting small quantities of tannic acid into rats. This central lobular liver necrosis is a prominent finding in deaths caused by burns and treated with tannic acid and the implications are in a measure suggestive.

One of the most gratifying effects of the treatment is the freedom from pain. The

excruciating pain of a burn ceases almost immediately following the application of horse serum. The amount of morphine that has to be given is very small indeed, even in severe burns. It can be postulated that the reason for this is that the serum coating protects the injured tissue from the air, and its pliability does not penalize the patient for the almost constant and often unavoidable movements that he goes through. Although the premise sounds quite reasonable, it must be admitted that exposing the raw surface to air is not the cause of pain in burns, because another type of wound of comparable size, so exposed is not usually painful. In 1937, Rosenthal[9] found in the blood of burned animals a histaminoid substance. This substance would doubtless be an irritant to the sensory nerve endings, and produce severe pain.[10] Rosenthal[9] found that this histaminoid substance was neutralized by serum from humans and animals in the healing stage of burns, and that even normal serum would do this to some extent. In the topical application of normal horse serum to burns, this toxin is neutralized at the source.

The absence of infection in the serum-treated wound is striking. It is doubtful, however, that the small concentration of cresol that keeps the horse serum sterile, could be a factor in keeping the wound sterile. It must certainly be true that something in the horse serum helps the superficial layers of cells to fight the bacteria that seek to destroy them. The bactericidal activity of normal horse serum has been the subject of many extensive reports chiefly by Gordon,[11] Mackie and their co-workers. Their conclusions were that there was present in normal horse serum the precursors of immune antibodies, although specific natural antibodies for certain bacteria were not present. Gordon thought that the bactericidal activity of normal horse serum was due to its content of complement and a heat stable intermediary factor. This factor was absorbed by the bacteria and was toxic to them.

Earlier in the paper, reference is made to the pouring out of an excessive amount of plasma from the burned area with failure of the plasma to jell adequately. The burned area literally appears to weep torrents of plasma. It does not make sense to continue to pour plasma into the circulation while it seeps out of the burned areas like rain through a porous roof. The accumulation of plasma in the tissues around the burned area may still be restored to the vascular system if and when

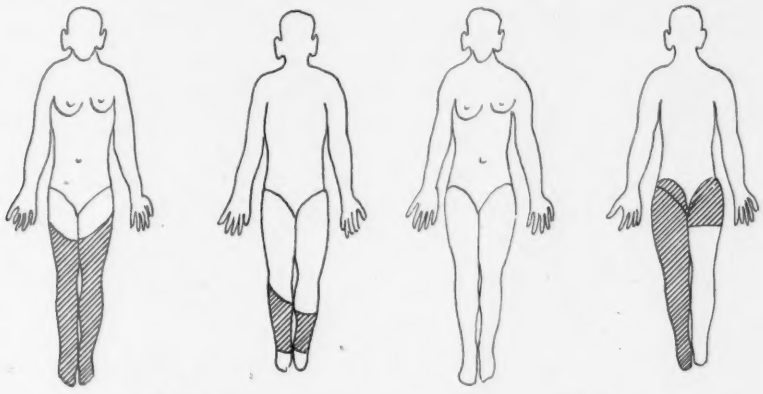

Fig. 5. Fig. 6.

Fig. 5. Case xxvii. F. D., age seven, female. Hot water burn. Received tannic acid treatment at home. Temperature elevated on fifth day and continued to fifteenth day. Healed without scarring in thirty-five days.

Fig. 6. Case viii. I. G., age fifty-four, female. Hot water burn. Infected burn following two weeks treatment with tannic acid at another hospital, tan lifted. Horse serum applied, healing wound in fourteen days.

the constant seepage of plasma oozing out of the burned surface is physiologically plugged. For many years the principles

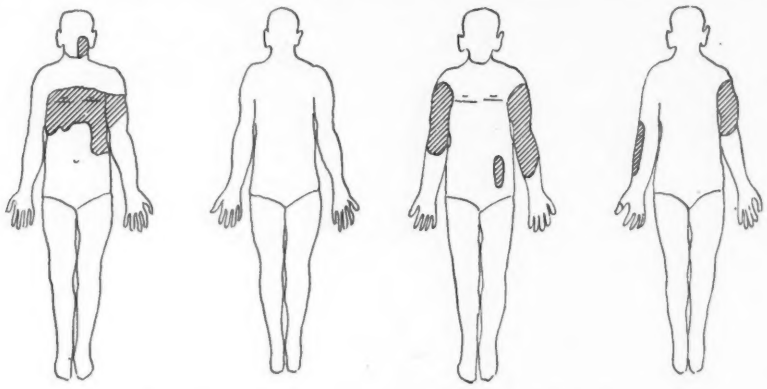

Fig. 7. Fig. 8.

Fig. 7. Case xxiii. I. L., age six, male. Hot water burn. Healed in sixteen days without scars or contractures.

Fig. 8. Case xxxii. J. F., age thirty-four, male. Fire burn due to clothes catching fire. Tannic acid treatment at another hospital. Eschar covering burn undermined with pus. Eschar removed and horse serum sprayed after saline soak for one day. Epithelization complete in fifteen days.

involved in the alteration of proper jelling of the plasma in burned areas and the mechanism by which application of normal horse serum to burned areas tended to re-establish adequate jelling was not understood. Recently, Rabinowitz[12] has pointed out the important rôle that the sulfur amino acids, such as cystine and methionine, play in the mechanism of normal clotting and clot rectraction. Cysteine, e.g., (—SH group) which is an intermediary of cystine, e.g., (—SS-group) metabolism definitely prevents the formation of a firm retractile coagulum. It is conceivable that in the face of excessive protein breakdown such as is very much in evidence in burns, that cysteine, e.g., (—SH group) vitiates the adequate jelling of the plasma in the burned area. In advanced stages of proloned toxemia in burns with liver damage, it is likewise conceivable that adequate cystine metabolism is impaired with resultant general

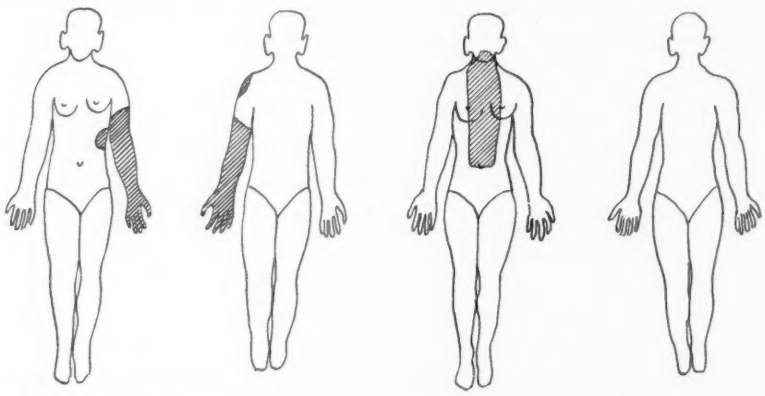

Fig. 9. Fig. 10.

Fig. 9. Case xx. S. R., age twenty-one, female. Ignited alcohol burn. Temperature on admission 104°F., then fluctuated for five days. In ten days, elbow exercises instituted. Healed in nineteen days except for slight granulating wound.

Fig. 10. Case iii. K. B., age two, female. Hot water burn healed in twelve days.

preponderance of the (SH-group) e.g., cysteine. In that event, the picture would be parallel to that of thrombocytopenic cells. The heavily tanned areas can be compared to the cellophane in the example cited above. The thick, unyielding coating

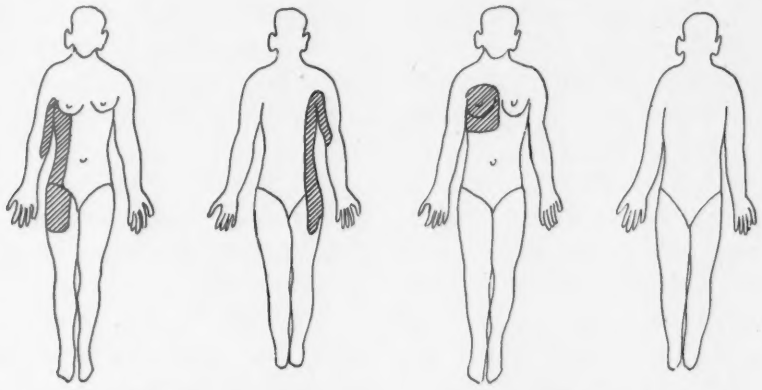

Fig. 11. Fig. 12.

Fig. 11. Case xxvi. M. B., age seven, female. Flame burn, due to matches. Temperature ran from 101° to 103°F. for nine days, then flat. Rose to 103°F. on twenty-fifth day and continued high until thirty-second day. Had two transfusions of whole blood. Healed in sixty days w thout scarring or limitation of motion.

Fig. 12. Case xxx. R. R., age forty-two, female. Boiling water burn three days before admission. At that time necrotic areas completely encircled breast. Septic temperature for fourteen days. Two transfusions given. Purulent area had to be incised. Developed serum sickness (hives) on eighteenth day. No treatment required. Epithelization well along on thirty-sixth day.

purpura.[12] Purpuric manifestations and gastroenteric bleeding in the late stages of severe burns is not uncommon and lends added importance to the postulate. Serum or plasma causes a rapid disappearance of the (—SH) groups, e.g., cysteine. Furthermore, normal serum contains cystine and methionine[12] which tend to restore firm clotting and clot retraction and thereby act as a physiological plug to the constant seepage of plasma from the burned area.

Du Nouy,[13] in his intensely interesting book, "Biological Time," gives some hint why unyielding and heavily tanned areas are unphysiological, retard healing and often require skin grafting. When part of a wound is covered by a sheet of sterile filter paper, it can easily be seen that the epithelization progresses more rapidly when the cells have been protected. On the other hand, when the wound is covered by a sheet of impervious cellophane, there is complete inhibition of the growth of does not act as a bridge for the growth of the delicate young tissue cells, as does the serum coagula.

The local application of horse serum acts as a "sparer" of the natural mobilization of plasma over the burned area. The outpouring of plasma appears to be an attempt on the part of the organism to replenish the protein destruction caused by the burn. If horse serum is applied to a burn surface, and is artificially coagulated by heat, we may be "sparing" the body's content of plasma by physiologically plugging the leakage over the burned area. Since epithelization takes place along a fibrin network, it does not take place readily in large burns unless aided. The artificially coagulated applied serum and wound plasma act similarly to a fibrin network and aid epithelization.

Since plasma contains fibrinogen it appeared to be ideally suited for this purpose and it was decided to use human plasma topically on one case. A third

degree burn involving almost the entire right forearm (Fig. 1), hand and fingers was treated with plasma in conformity with the previously stated horse serum routine. However, it was impossible to continue this treatment beyond the sixth day because of the expense incurred. The remainder of the treatment was carried out with normal horse serum. It was noted that the burn healed completely without gross scarring (Fig. 2) or contractures. If the cost of human plasma can be brought down, it would probably be ideal for topical application in burns. In the meantime, artificially jelled normal horse serum remains a tried and efficient substitute.

If we list for didactic purposes, the stages of reaction in burns,[14] as primary shock, secondary shock, acute toxemia, and septic toxemia, we can see how horse serum applied topically acts as more than a local coating for the burn. Primary shock arises immediately after a burn, and is probably due to pain and fright. If the horse serum is immediately available, pain is at a minimum and this period would be extremely short. Otherwise adequate doses of morphine must be given. Secondary shock is ostensibly due to increased capillary permeability in the burned area, and indeed over the entire body. If the outpouring of plasma over a burned surface is due to nature's attempt to replace the destroyed protein, the leakage can be limited at its source by applying jelled horse serum or human plasma. If hemoconcentration and hypotention develop, intravenous administration of plasma is the appropriate medication. The acute toxemia or toxic stage of a burn usually occurs forty-eight to seventy-two hours afterward. There is much evidence to show the existence of a toxin in the burned area. The edema fluid of a burn gradually becomes more toxic. The blood of burned animals contains a histaminoid substance which can be antagonized in part by normal serum. By the application of serum this substance is antagonized at the outset. The last stage of septic toxemia is due to bacterial infection of the burned area. Normal horse serum has been shown to be definitely antagonistic to the growth of bacteria.

In the entire series, only one case showed a mild form of serum sickness. It was thought unnecessary for this reason to skin test the patients before the use of topically applied serum. This case of serum sickness was of the type that occurs regularly in non-serum sensitive patients following the injection of horse serum.

Although in this study, topical application of appropriate medicaments was studied from the standpoint of healing, this should not be taken to minimize the importance of the recent work on the general treatment of burns, such as plasma transfusions and the adrenal cortex treatment of burn shock. However, it is our impression that investigators have placed too little stress on local treatment. The ideal consists of a balanced combination of both of these methods.

The advantages of local serum application over other forms of treatment are: (1) The processing and economic yield of horse serum has long been established and is easily transportable. (2) The application of serum obviates cumbersome dressings and permits of rapid evacuation of location. (3) The administration of sedatives or narcotics is reduced to a minimum resultant from freedom from pain. (4) Hypoproteinemia and dehydration are prevented in a great measure with resultant reduction of the use of intravenous plasma. (5) Painful and time consuming débridement is rendered unnecessary. (6) Adequate epithelization and absence of debilitating scar tissue eliminate skin grafting in a great measure.

SUMMARY

1. Fifty-two patients with severe second and third degree burns were treated by the topical application of normal horse serum. These cases were studied over a fifteen-year period.

2. The lack of infection, the absence of pain, the speed of epithelization, and the comparative absence of scarring were striking features.

3. A short note on the topical application of human plasma in severe burns is inserted.

4. No skin grafting had to be done on any of these patients.

5. The rôle of the protein degradation products, cystine, cysteine and methionine, in the process of plasma coagulation in burned areas was discussed.

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EXOPHTHALMOS*

DIAGNOSIS AND SURGICAL TREATMENT OF INTRACTABLE CASES

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THE causes of exophthalmos, which attracts special attention in large thyroid centers, are many. For that reason, one must be acquainted with the differential diagnosis so that an orderly investigation as to etiology can be conducted, and as soon as the diagnosis has been made advice as to treatment and probable prognosis given. (Table 1.)

In the normal person the prominence of the eyeballs varies considerably. The normal range, as measured by the exophthalmometer, is from 10 to 20 mm. Many persons are normally so-called "pop-eyed," and prominence of the eyeballs may be a family characteristic. The word exophthalmos should be used only to describe abnormal protrusion of the eye or eyes, which should not be confused with the stare so frequently associated with hyperfunction of the thyroid gland. Whether a protrusion has occurred or is in progress is usually evident or volunteered by the patient, his family or friends.

Thyrotoxicosis, which is the most common cause of exophthalmos, is usually bilateral but may be unilateral. In the majority of cases the diagnosis is not difficult because of toxic signs, although in three of our patients rapidly progressive exophthalmos was present one to three months before the toxic manifestations were evident.

In a large series of patients with hyperthyroidism, Cattell[5] found that 21 per cent showed persistence of the preoperative exophthalmos, but only 1.1 per cent showed an increase following operation. The latter patients are of especial interest to the neurosurgeon since in a few cases the exophthalmos will progress to such a

TABLE 1
EXOPHTHALMOS: BILATERAL AND UNILATERAL
Etiologic Factors, Eighty-seven Cases, 1933–1943

Systemic	
Thyroid disease	28
Hypertension	5
Syphilis	1*
Leukemia	1
Angioneurotic edema	0
Prolonged use of thyroid extract in obesity	2
Pyemia resulting in orbital abscess	1†
Paget's disease	2
Intracranial pressure (causing pressure erosion of orbital plates)	
Brain tumor	4
So-called "increased intracranial pressure without tumor"	2
Congenital	
Encephalocele	0
Aneurysm: arteriovenous (orbital varicosity)	1
Aneurysm: internal carotid and ophthalmic artery	1
Cranial synosteosis	2
Orbital tumors	
Sphenoid wing meningioma (hyperostosing)	11
Schüller-Christian disease	0
Osteoma	3
Cholesteatoma	3
Carcinoma: metastatic	2
Carcinoma: primary nasal sinus	1
Sarcoma: osteogenic	1
Sarcoma: neurogenic	1
Sarcoma: rhabdomyosarcoma	0
Angioma: arterial	1
Angioma: venous	1
Angioma: lymphangioma	0
Glioma of optic nerve	2
Neurofibroma	1
Mucocele	1
Pseudotumor	1
Mixed tumor of lacrimal gland	1
Lipoma	0
Fibroma	0
Infections	
Osteomyelitis: pyogenic	1†
Osteomyelitis: tuberculous	1
Osteomyelitis: syphilitic	1*
Cavernous sinus thrombosis	2
Orbital abscess	1
Infection of lacrimal gland	1
Trauma	
Hematoma of orbital tissues	1

* Same case.
† Same case.

* From the Department of Neurosurgery, The Lahey Clinic. Presented before the meeting of the Inter-State Post Graduate Medical Association of North America, Chicago, October 28, 1942.

degree that orbital decompression is necessary to save the vision.

Our experience with surgical treatment for severe progressive exophthalmos has been limited to twenty-eight patients since 1933. In most of these cases sufficient time has elapsed so that the clinical course and end results can be ascertained fairly completely. Eleven of the patients were males and seventeen females. Their ages ranged from twenty-seven to sixty-seven years.

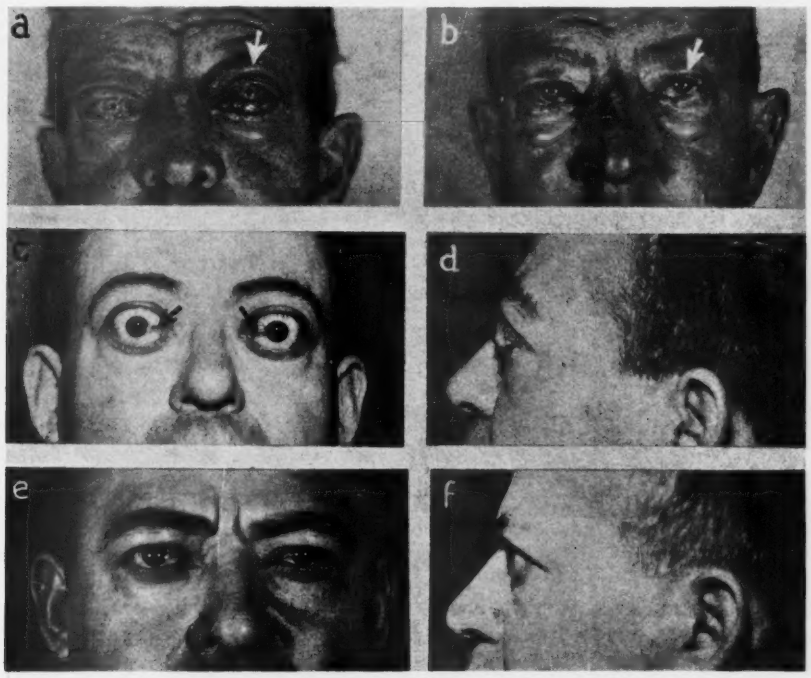

FIG. 1. *a*, a moderate degree of exophthalmos, with marked conjunctival edema, extra-ocular muscle palsy and papilledema of the optic disks. The chemosis of the left eye is so great that keratinization has taken place; in this type of patient lateral tarsorrhaphy may be of value after the decompression. Great swelling of the upper eyelid can also be noted. *b*, two months following operation, with a lid suture of the lateral canthus. The edema of the left upper eyelid and chemosis have subsided to a great degree. *c* and *d*, definite progressive exophthalmos with only slight chemosis and swelling of the eyelids. Exposure hyalinization and overvascularization of the conjunctiva medially which corresponds to the width the eyelids are open even while asleep. Patient had corneal abrasions but no papilledema. *e* and *f*, after orbital decompression.

The indications for operation are not always clear, resulting in a conflict of opinions as to whether a patient should be subjected to orbital decompression. The operation is neither suggested nor advised for purely cosmetic purposes, although a striking improvement in appearance usually results. The only real indication for extensive orbital decompression is progressive exophthalmos in the presence of increasing visual changes, which subjectively usually consist of diminished, blurred or double vision with photophobia and lacrymation. Obviously, acute swelling of the lids, chemosis and sometimes keratinization of the conjunctiva may be present. Epiphora is distressing and leads to frequent eye wiping and subsequent bouts of acute conjunctivitis. External ocular muscle palsy is common. An occasional patient shows corneal ulceration and extension of infection. The width the eyelids are apart often can be determined accurately when the patient is asleep, or the inability of the eyelids to close can be determined by the degree of discoloration of the conjunctiva at the lateral and medial portions of the eyeball.

(Fig. 1c.) The fundus may appear normal or show venous congestion and varying degrees of papilledema. If the process is unrelieved, subluxation of the globe, blindness or even meningitis and death may result. Infrequently, long-standing, marked exophthalmos may be associated with slight optic atrophy and an occasional extra-ocular muscle palsy, and yet such a case may not fall into the category of progressive exophthalmos. Operative indications can be determined only by a long period of observation.

FIG. 2. Progressive essential hypertension with sudden development of arteriovenous aneurysm producing pulsating exophthalmos of the left eye with marked conjunctival edema. *a*, previous to operation; *b*, five months after ligation of the common carotid artery and bilateral splanchnicectomy.

The prevention of these symptoms and signs should concern all who come in contact with suspicious cases. Any patient with exophthalmos which fails to recede or increases following thyroidectomy should be under the observation of a physician competent to determine whether surgery is indicated. The optimum time is variable and depends somewhat upon the surgeon's experience and previous observations, but in a patient without thyrotoxic symptoms and with severe, progressive exophthalmos (usually a protrusion of 25 to 30 mm.), progressive visual changes, and a normal or subnormal basal metabolic rate, orbital decompression unquestionably is indicated.

The evaluation of previous statistics in the measurement of exophthalmos is difficult, particularly if one depends upon the so-called grading system. Due to puffiness of the eyelids and variable degrees of conjunctival edema, false impressions are obtained easily, and the actual proptosis may be greater in the seemingly less prominent eyeball.

The exophthalmometer in experienced hands has done much to improve our records at the Lahey Clinic. Measurements are taken routinely in the re-examination of thyroid patients showing exophthalmos, and at the earliest sign of progression, with the visual changes already described, the patient is seen in consultation by a neurosurgeon. A description of the actual use of the exophthalmometer is unnecessary, since one should be well acquainted with it. Because of the discrepancy in readings made by different persons on the same patient, whenever possible the preoperative, postoperative and follow-up readings should be made by the same person. Our measurements have been made with the Hertel exophthalmometer which registers a normal figure of 15 to 17 mm. In order to estimate accurately

the amount of improvement or progression in a given case, the use of the same base line throughout is important.

years, the actual visual symptoms for which operation was indicated preceded decompression by only one and a half to

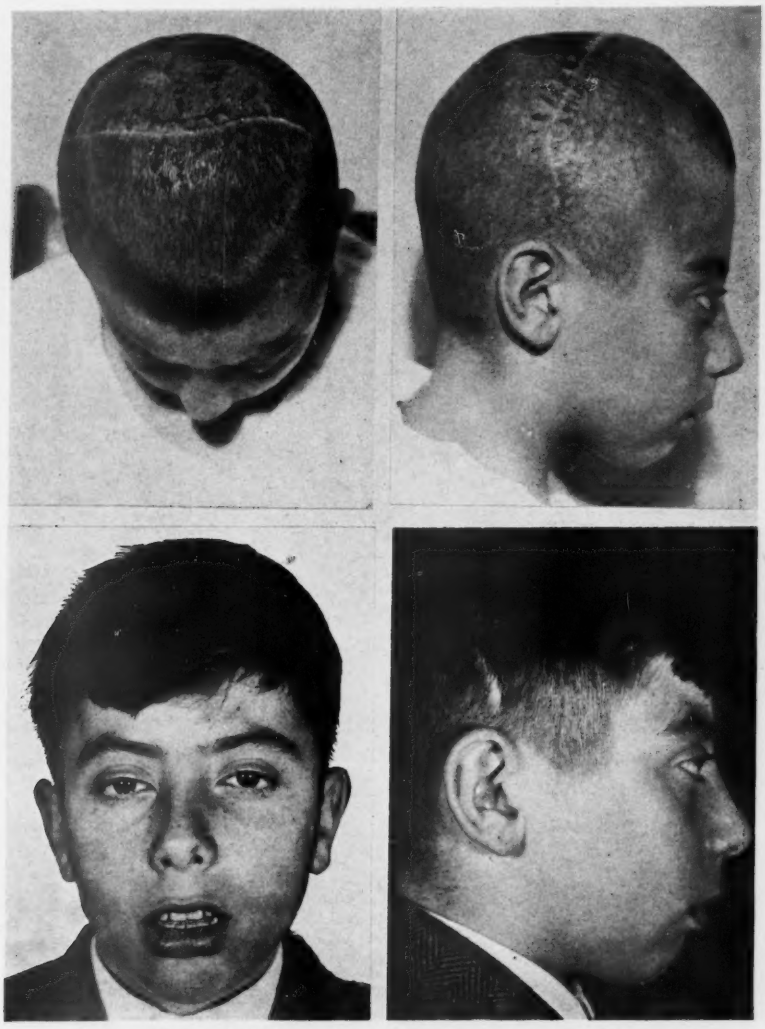

Fig. 3. Bilateral exophthalmos from cranial synosteosis. The prominence of the eyeballs is still noted eight days following artificial production of suture lines as described by King.[12] Eyes and head are normal two years following operation as demonstrated by the lower photographs.

The preoperative maximum and minimum readings in our patients varied from 37 to 19 mm. respectively, twenty of the twenty-eight cases having protrusion of 25 mm. or over. In eight the measurements were exactly the same in the two eyes. The others showed 1 to 6 mm. of difference in the two eyeballs.

In twenty cases progressive exophthalmos appeared following the first thyroidectomy. Even though exophthalmos of some degree usually was present before thyroidectomy for periods of one month to six ten months. Marked visual changes were almost always recent in duration (one to three months). This illustrates that the development of exophthalmos is not always in direct proportion to ocular signs and symptoms. (Fig. 1*a*.)

Four of our patients showed no alteration in the orbital tissues until after a second thyroid operation. In two cases exophthalmos reached the progressive stage concomitantly with a thyrotoxicosis sufficient to necessitate a thyroidectomy followed within three months by an orbital

decompression. One patient showed advanced visual changes necessitating orbital surgery approximately four months prior to the indications for a subtotal thyroidectomy. One patient had roentgen therapy for toxic goiter ten years before orbital decompression. In the remaining two patients exophthalmos could not be related definitely to thyroid disease.

Apparently no direct relationship existed between the rapidity of the development of exophthalmos and extra-ocular palsy. Correlating the degree of exophthalmos with ocular paralysis, the latter was more frequent, with moderate rather than severe proptosis. The degree of resistance of the orbital tissues, which is almost like that of a brawny edema, can be determined by exerting pressure on the eyeball. If the tissue allows the eyeball to sink into it relatively normally, catastrophe is not imminent. Twenty-five patients presented limitation of the extra-ocular movements, usually in the horizontal and vertical

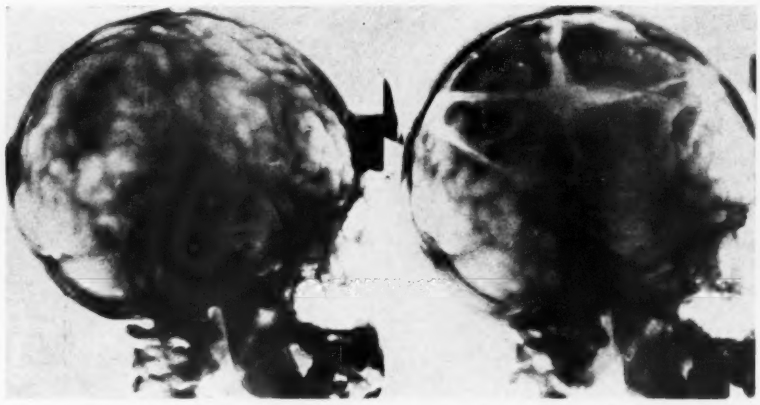

FIG. 4. Same patient as shown in Figure 3; preoperative and postoperative roentgenograms.

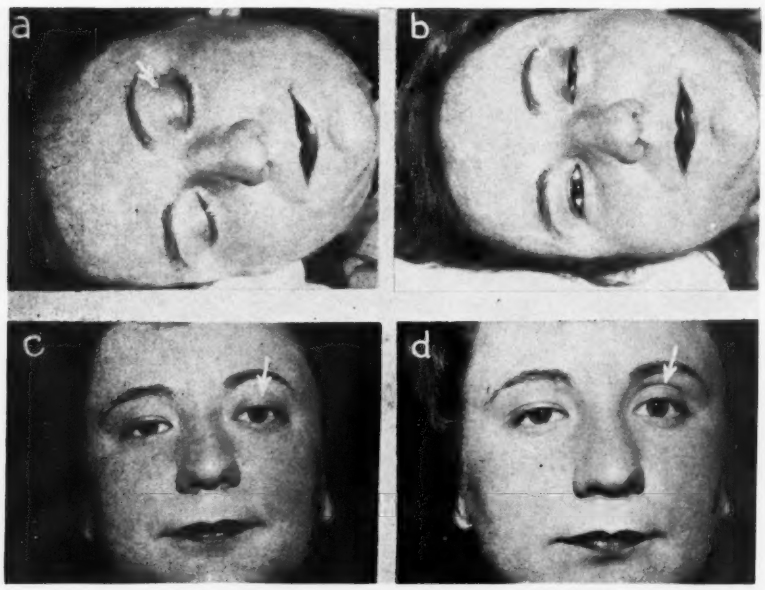

FIG. 5. Intermittent postural exophthalmos. *a*, Trendelenburg position, with considerable fullness and protrusion of the left eyeball. *b*, lid droop on the left side upon attempting to open both eyes; *c*, one minute following the Trendelenburg position, in the upright position; considerable protrusion of the eye, the arrow pointing to the fullness of the upper eyelid; *d*, upright position two minutes after *c*; 8 mm. recession of the eye. The normal wrinkles can be seen in the upper eyelid.

planes, indicating extensive muscle involvement. Nineteen patients mentioned diminished or blurred vision as a chief complaint, and sixteen complained chiefly of double vision. In one patient blind spells caused the greatest difficulty.

FIG. 6. Tuberculous osteomyelitis arising in the left maxillary sinus with definite exophthalmos and complete ophthalmoplegia caused by swelling of the retro-orbital tissues.

Eleven patients specifically mentioned marked lacrymation, but objectively this was present in all cases. Three showed photophobia, and only one complained of headaches. Sixteen patients showed varying evidences of papilledema. This ranged in degree from the appearance of early changes to an elevation of 5 diopters, and among these cases two showed early optic atrophy. Six further patients showed venous congestion and two of these had moderate pallor of the disks. One patient had pallor alone. The remaining five patients showed essentially normal fundi. Two had corneal ulcers or scars preoperatively.

The basal metabolic rate was determined in twenty-five patients just preceding orbital decompression and varied from −20 to +21 per cent. Four had distinctly low levels, varying from −16 to −26 per cent, while only one had a rate above normal (+21 per cent). This patient was taking thyroid extract daily.

In our series of twenty-eight operative cases of progressive exophthalmos, twenty-six were associated with previous thyrotoxicosis. Twenty-four had primary thyroidectomies. One patient had had roentgen therapy ten years previously. One patient entered the hospital with a history not unlike that recently described by Brain[4] as exophthalmic ophthalmoplegia. The symptoms were unilateral, and no indication of thyroid involvement occurred until four months after orbital decompression. Subsequently thyroidectomy completely relieved the toxic symptoms. The other two patients had similar stories, with the exception that to date they have developed no manifestation of thyroid toxicity.

Before resorting to orbital decompression, in certain cases other measures were attempted in an effort to relieve the progressive state of the exophthalmos.

Thyroid medication was given a trial in nine patients with a low basal metabolic rate, but this failed to improve the ocular status. Three patients were subjected to three thyroidectomies and three others to two, but the exophthalmos was unrelieved and all had subsequent orbital decompression. Therefore, even though operations for thyroid remnants may be necessary in the presence of toxicity, such procedures have no helpful effect on an existing progressive exophthalmos.

Lugol's solution was used in five cases. Only one patient thought there was slight, transient improvement in the exophthalmos, but this was not noted objectively. One patient who had a poor result after orbital decompression was subjected to roentgen therapy, but the exophthalmos became worse thereafter. Bilateral cervical sympathectomy has been disappointing in several cases, and one patient so treated had an orbital decompression two months later. Other similar cases in which the exophthalmos is marked but not typically progressive are being followed. All patients subjected to sympathectomy complain of discomfort from the dry nasal mucous membrane. Even though the lid droop may be of some help, there is no improvement in the proptosis as measured by the exophthalmometer. Readings have been made by Cattell and Beetham[6] in several patients at the time of thyroidectomy while the cervical sympathetic chain was stimulated. A questionable 1 to 3 mm. change in protrusion was noted in patients with exophthalmos; no change was noted in patients without exophthalmos.

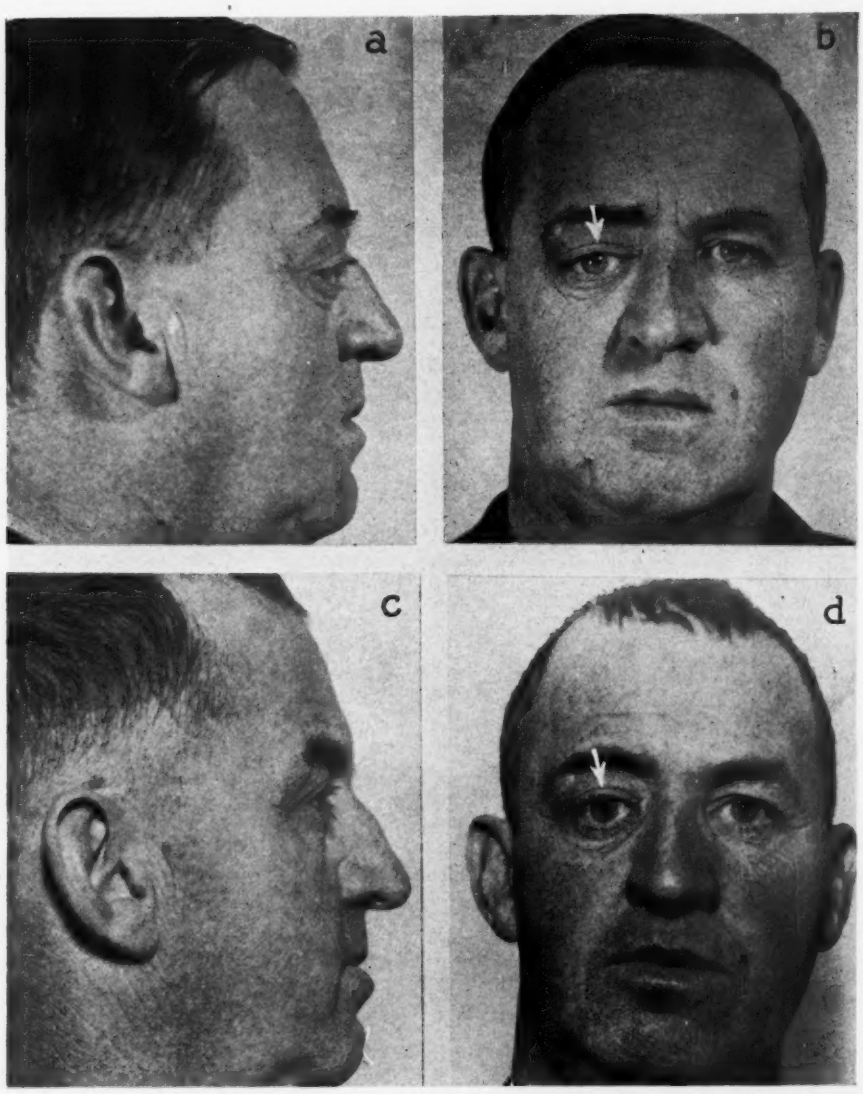

FIG. 7. *a* and *b*, before operation, a downward forward displacement of the eyeball caused by osteogenic sarcoma involving the right frontal bone and orbital plate; *c* and *d*, same patient six weeks following operation.

In 1931, Naffziger[16] introduced orbital decompression for the relief of certain patients who developed a severe form of

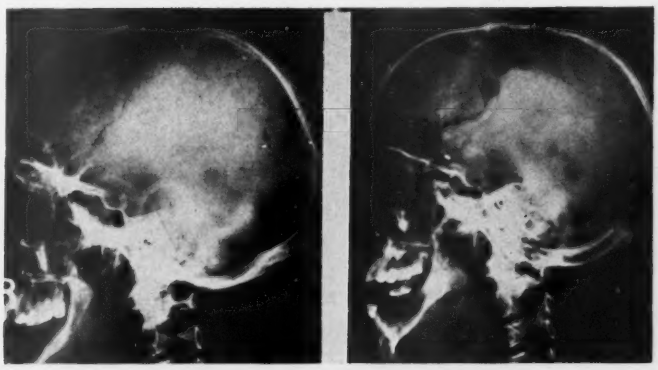

FIG. 8. Same patient as shown in Figure 7; preoperative and postoperative roentgenograms.

FIG. 9. *a* and *b*, unilateral exophthalmos from a retro-orbital neurofibrosarcoma; *c* and *d*, thirteen days following complete extirpation of retro-orbital tumor transcranially.

progressive exophthalmos following thyroidectomy. Previous attempts to relieve this condition had failed completely, and

Fig. 10. Exophthalmos caused by benign neurofibroma involving the first division of the trigeminal nerve retro-orbitally.

the patients went on inevitably through stages of chemosis, corneal ulceration and panophthalmitis, or developed papilledema, optic atrophy and blindness. Many were subjected to enucleation of their eyes as a lifesaving measure. Other procedures such as canthotomy, canthoplasty and tarsorrhaphy, plastic operations, removal of orbital fat, ligation of the superior ophthalmic vein, and division of the cervical sympathetic nerve, were of help in only a few of the less extensive cases.

Naffziger,[19] in his most recent article, reported the clinical aspects of thirty-one cases of orbital decompression, eight of which were from his own clinic. There were two deaths and four poor results. Other reports of cases include those of Semmes,[24] Merrill and Oakes,[15] Bothman,[2] Thomas and Woods,[25] Rosenbaum,[22] Brain,[4] Kistner,[13] Brady[3] and Guthrie.[11] These authors agree on the generally favorable results of orbital decompression, even though a few depict it as a procedure of great magnitude.

While the general method of performing orbital decompression remains essentially the same as described by Naffziger[16,17,18] in his original and subsequent articles, there are certain slight modifications, together with a few preoperative and postoperative suggestions which we have found helpful.

OPERATIVE TECHNIC

The patient is given a general anesthetic with avertin supplemented by endotracheal ether. Before placing the usual drapes for craniotomy, complete but temporary tarsorrhaphy is performed. This not only improves the operative result but reduces to a minimum the postoperative conjunctival reaction and safeguards against a new corneal ulcer. Occasionally, in patients with marked conjunctival edema and keratinization of a portion of the conjunctiva (Fig. 1*c*) a permanent lateral tarsorrhaphy is necessary after the orbital decompression.

Through a modified coronal incision, bilateral, narrow, v-shaped bone flaps are turned down, the broad portion of the bone flap being under each temporal muscle as far anteriorly as possible. After the dura is separated from each orbital plate to the sphenoid ridge, the decompression is executed bilaterally by removing the orbital plates anteriorly to the frontal sinuses, medially to the ethmoid sinuses, and posteriorly including each entire sphenoid wing. The optic nerves are uncapped. The lateral portion of each orbital plate is rongeured completely away inferiorly to the superior and inferior oblique tissues. The orbital periosteum and fascia are then opened widely. In all of our earlier cases the fascia was divided through the annulus of Zinn. It was thought, however, that extra-ocular muscle palsies were increased and therefore in the recent cases this has been left undone. Satisfactory results have been obtained, even if there is a choking of the optic disk, without incising the annular ligament of Zinn.

Immediately on opening the fascia, edematous fat tissue and muscle extrudes. The individual muscles are two or three times their normal size and are grossly firm with a gray appearance. The pathologic sections show round cell infiltration and fragmentation of the muscles, as well as myxedematous changes.

After all bleeding points have been carefully controlled, a generous amount of

sulamyd powder is inserted into the operative wound, the bone flaps are replaced, and the scalp sutured with interrupted black silk. Occasionally, small rubber tissue drains are left superficially.

FIG. 11. Cholesteatoma involving the orbit. *a*, unilateral protrusion of eyeball; *b*, postoperative recession; *c*, preoperative roentgenogram; arrow shows bony defect in the orbit well separated from the frontal sinus; *d*, postoperative roentgenogram.

As soon as the operative drapes are removed, the eyes show immediate marked recession and some pulsation. The sutured eyelids are covered generously with White's ointment and moist sea sponges, and by means of an Ace bandage, equal pressure is applied to both eyes.

RESULTS

The results of operation have been gratifying in all but two patients. In one of the earlier patients, because of extensive ethmoidal cells extending over the orbital plate, adequate decompression could not be performed. With the sulfa drugs, however, removal of the entire orbital plate including the ethmoidal cells is permissible provided the dura has not been opened. Therefore, possibly the death of this patient who first lost his eyeball because of progressive exophthalmos could have been avoided. In the second patient the eyeballs were saved; however, there was an increase in the extra-ocular muscle palsy probably due to incising the annulus of Zinn.

The degree of regression of exophthalmos was up to 6 mm. during the first year following operation, after which improvement seemed to be more gradual. Extra-ocular palsy, especially convergence, was prevalent preoperatively. Although all general movement returned postoperatively, full function returned in only a few cases. Subjectively, however, the patients were unaware of this. Sixteen patients presented diplopia as a chief complaint, twelve of whom were completely relieved by operation. The disappearance of the double vision was not always immediate but took place after a variable period of time, usually a few weeks to a few months. Nineteen patients showed diminished vision preoperatively, all of whom improved remarkably with the exception of one. Occasionally, optic atrophy from receding papilledema was noted. Three patients had generalized constriction in their fields, and three also showed enlarged blind spots, one of whom likewise presented a right inferior quadrantic field defect. Operation

resulted in some improvement in all these patients with the exception of the one with the field defect.

The presence of corneal ulcers or scars was noted preoperatively in two patients. Four additional ulcers occurred after operation in our earlier cases before lid suturing was performed routinely.

Three patients had marked but temporary frontal lobe symptoms including confusion, disorientation and semiconsciousness which continued for two weeks, four weeks and four days, respectively. These changes undoubtedly were due to retraction on the frontal lobe resulting in postoperative edema; however, in one patient the same reaction occurred following a previous thyroidectomy. There were no operative deaths from the bilateral orbital decompression.

COMMENT

There is little to justify allowing a patient to continue conservative measures until it is questionable whether the eyeballs can be saved even by a bilateral orbital decompression. This is particularly true since the mortality in competent hands is negligible, and the results both in saving eyesight and from a cosmetic standpoint are good when the operation is done relatively early. It is of interest to note that our results have improved as our experience has increased. This is due to increasing the extent of the orbital decompression as well as temporary lid suture and postoperative pressure bandages.

Completion of the orbital decompression in one stage saves the patient both mental and physical discomfort.

Even though the recession of the eyeballs following orbital decompression is not dramatic in every case, the fact that the malignant process and loss of vision are arrested makes the procedure worth while. In the decision as to whether an orbital decompression is indicated in a patient with probable progressive exophthalmos, it seems wise to prove definitely by exophthalmometer readings and findings that the condition is progressive. On the other hand, one should deny a patient an orbital decompression purely from a cosmetic standpoint.

Naffziger[16] should receive all the credit for having both the practical foresight and conviction that decompression of the orbital contents in these patients would save vision as well as eyeballs. It now seems the perfectly obvious procedure.

We have had no occasion to decompress the orbital contents by removal of the walls of the nasal sinuses nor does this seem a procedure of choice from the aseptic standpoint. However, it might be of considerable value in a patient with large sinuses precluding adequate decompression of the orbital tissue in the manner described previously. It seems the better part of valor to complete as extensive an orbital decompression as possible intracranially, and after the intracranial contents are well sealed, perform the sinus operation as described by Kistner.[13]

A point worthy of emphasizing in postoperative treatment is that obesity must be avoided, and if present, treated by diet especially in a patient in whom the orbital fat is abundant at the time of operation. No attempt has been made in our cases to resect the fatty tissue at the time of decompression for fear of increasing or producing extra-ocular muscle palsy.

The other causes of bilateral exophthalmos are rare. Hypertension is described by Ruedeman[23] as causing protrusion of the eyeball up to 8 mm. In his series, no decision concerning treatment was reached due to death of the patients before any serious difficulty with the eyes was experienced. Our only experience with exophthalmos in hypertension has been limited to five cases; four were bilateral and one unilateral occurred in a thirty-two year old woman who during labor developed a sudden, subjective bruit behind the left eye with a rapidly progressive, pulsating exophthalmos on that side. Thoratrast injection of the internal carotid artery demonstrated a typical picture, the dye

A

B

FIG. 12. Hyperostosing sphenoid wing meningioma involving the right orbit. A, preoperative anteroposterior and lateral views, the photographs corresponding with the roentgenograms, demonstrating the unilateral exophthalmos; B, recession following operation.

passing immediately into the jugular vein and not into the cerebral arteries. Ligation of the common carotid artery after adequate preoperative occlusion with a light carotid pressure clamp reduced the intensity of the bruit but did not abolish it. One week later a splanchnicectomy was performed with complete subjective as well as objective relief of the bruit. (Fig. 2.)

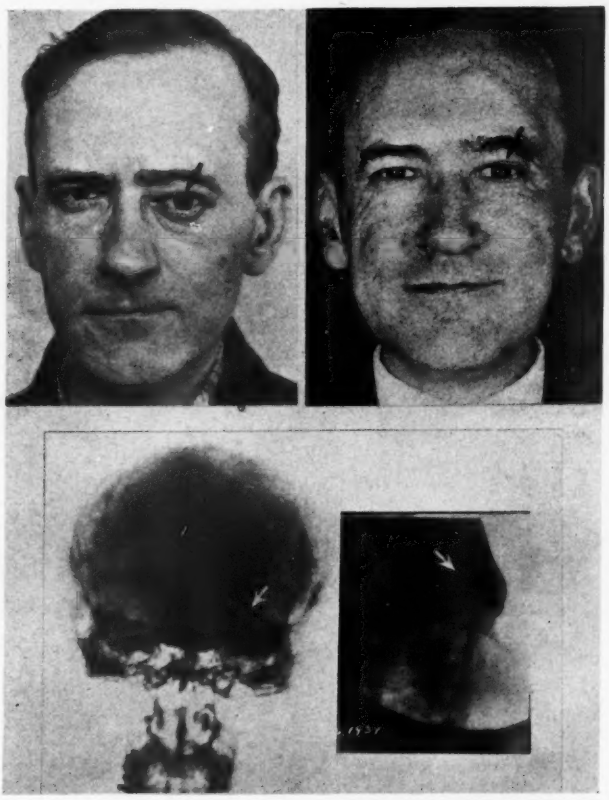

FIG. 13. Left unilateral exophthalmos with downward and lateral displacement of the eyeball typical of osteoma or mucocele. Large osteoma involving the entire left frontal sinus and portion of the right, displacing the orbit laterally.

Increased intracranial pressure of long standing may cause a protrusion of the eyeball due to erosion of the orbital plate, thus allowing direct pressure on the orbital tissue. The most common offenders in producing long standing pressure are benign pinealomas, craniopharyngiomas, colloid cysts of the anterior third ventricle and cranial synosteoses. (Fig. 3.) Paget's disease may cause bilateral protrusion of the eyeball because of a decrease in the size of the orbital cavity due to proliferation of bone.

The medical department of the Lahey Clinic has seen two patients who developed exophthalmos without hyperthyroidism by the prolonged use of thyroid extract for obesity, and one who developed exophthalmic goiter (6 to 9 gr. of thyroid extract daily for five to six years).

UNILATERAL EXOPHTHALMOS

The differential diagnosis of unilateral exophthalmos usually is not difficult; however, the patient's history may be inaccurate as to the duration of the exophthalmos especially in the gradually progressive, subjectively symptomless type, in which the patient notices the exophthalmos only when local symptoms such as gradual visual changes, pain or headache occur. As in all diseases, the frequency of the etiologic factors must be kept in mind and play a part in the tentative diagnosis. For that reason, a table of conditions causing

unilateral exophthalmos in forty-one cases encountered in the last nine years is given. (Table II.) It is of interest to note that not one patient with Schüller-Christian disease was encountered, whereas Dandy[8] in his series of orbital tumors found it to be the most prevalent.

TABLE II
UNILATERAL EXOPHTHALMOS
Etiologic Factors, Forty-one Cases, 1933–1943

Sphenoid wing meningioma		11
Meningioma involving frontal bone and orbital plate		1
Carcinoma	metastatic	2
	primary nasal sinus	1
Sarcoma	osteogenic	1
	neurogenic	1
Cholesteatoma		3
Osteoma		3
Glioma of optic nerve		2
Cavernous sinus thrombosis		2
Aneurysm	internal carotid	1
	arteriovenous	1
Angioma	venous (orbital varicosity)	1
	racemose	1
Mixed tumor of lacrimal gland		1
Pseudotumor		1
Mucocele		1
Orbital abscess		1
Osteomyelitis	pyogenic	1
	tuberculous	1
	syphilitic	1
Chronic infection of lacrimal gland		1
Hematoma of orbital tissues		1
Neurofibroma		1

Statistics, therefore, in a relatively uncommon condition cannot be used as an accurate guide in diagnosis; nevertheless if one is familiar with the possible causes, the ultimate accurate diagnosis can be made more quickly and may serve to save a patient's vision, distressing deformity and even life.

Sudden or acutely developing exophthalmos usually is associated with severe discomfort. This occurrence immediately excludes the more favorable types of tumor amenable to surgical removal. Localized infection of the orbital tissues can be recognized by the extreme tenderness of the orbital tissues to pressure, pain on attempt to move the eyeball, increased local and systemic temperature, and a history of recent infection elsewhere in the body, usually involving the face or nasal sinuses. A cavernous sinus thrombosis can be differentiated from the localized infection of the orbital tissues by the extreme malaise, hyperpyrexia, complete ophthalmoplegia, and usually a complete third nerve paralysis. The arteriovenous aneurysm also comes on rapidly, and may be associated with considerable pain and tenderness locally around the affected eye. However, the patient is aware of a bruit synchronous with his pulse, and this also usually can be readily verified by auscultation, and the bruit can be diminished or completely abolished by digital compression of the internal carotid artery on the affected side. Many times pulsations of the eyeball can be seen. In the early stage the engorgement of the vessels is marked; however, because of the extreme chemosis of the conjunctiva that develops, this factor may be obscured. In the patient with arteriovenous aneurysm the pulse rate is usually increased. Arterial blood can be collected from the jugular vein. The usual roentgenograms of the skull may be normal; however, special arteriograms of the internal carotid artery demonstrate a characteristic defect and are characterized by the fact that only the internal carotid artery fills up to the fistulous tract and immediately empties into the internal jugular vein through the cavernous sinus, and for that reason, incomplete filling of the cerebral arteries takes place.

A hematoma formation in the orbital tissues, of course, can be identified readily since there is either a history of injury or blood dyscrasia, and the ecchymosis that develops in the upper and lower eyelids immediately verifies the diagnosis. Aneurysm of the internal carotid artery with erosion of the sphenoid wing and orbital plate with direct pressure on the orbital tissues can be recognized by roentgenograms of the skull with special attention to the orbit and sphenoid wing or by arteriograms.

The intermittent type of exophthalmos caused by the so-called "varicosities of the orbit" or venous angioma are dramatic in that there is a rapid protrusion of the

eyeball whenever the head is lowered beneath the heart level and practically a complete recession within a few seconds after the head is in the upright position. Eagleton[10] states they occur ten times more frequently on the left side than on the right. Reese[21] believes this may be due to the fact that the jugular foramen is usually smaller on the left side. (Fig. 4.)

Osteomyelitis producing exophthalmos may be due to syphilis, tuberculosis or pyogenic infection. The roentgenograms are usually characteristic. The favorite site of syphilis is the superior orbital rim. Tuberculous osteomyelitis is rare, but is usually primary in the nasal sinuses. (Fig. 5.) In some cases the differential diagnosis can be made only by biopsy except, of course, in the syphilitic types in which the blood serology is of utmost importance.

Carcinoma of the retro-orbital tissues is usually metastatic; however, it may be primary in the nasopharynx. Roentgenograms are of diagnostic value only when the carcinoma has invaded bone.

The osteogenic sarcoma may be recognized readily by the roentgenologic findings, whereas the neurogenic sarcoma (neurofibrosarcoma) can be differentiated from a neurofibroma only microscopically. (Figs. 6, 7, 8 and 9.)

The cholesteatoma, hyperostosing sphenoid wing meningioma and osteoma of the frontal sinus have characteristic roentgenologic findings, as demonstrated in Figures 10, 11 and 12. The osteoma and mucocele usually may be differentiated from the hyperostosing sphenoid wing meningioma by local examination. In the former two, the eyeball usually is depressed laterally with a fullness under the upper eyelid, whereas in the latter the eyeball usually is protruded in the midline with varying degrees of depression and a fullness of the temporal area on the affected side when compared with the opposite side. Early optic atrophy occurs in hyperostosing sphenoid wing meningioma. Usually little impairment of extra-ocular movement occurs in either condition until a marked degree of exophthalmos has developed, whereas in all the malignant orbital tumors and infections an early limitation of ocular movement is present. Pressure on the eyeball through the closed eyelids during examination is of value since in all orbital new growths a definite sense of resistance can be detected.

A glioma of the optic nerve must be suspected in early unilateral visual changes and characteristic changes in the optic disk by ophthalmoscopic examination. Roentgenograms of the optic foramina are of considerable value and many times establish the diagnosis. Roentgenograms of the optic foramina should be taken in all patients with unilateral exophthalmos in whom the diagnosis is not evident immediately from the history, neurologic examination or the usual roentgenograms of the skull.

TREATMENT

The treatment of the hyperostosing sphenoid wing meningioma, which has been described previously,[20] is entirely surgical.

The osteoma and mucocele may be removed satisfactorily and with gratifying cosmetic results either transcranially through a small frontal bone flap or by a direct attack on the frontal sinus.

The arteriovenous aneurysm may need both extracranial as well as intracranial operations, as described by Dandy.[7,9] In three cases Adson[1] found it necessary to ligate the common internal and external carotid arteries cervically as well as do an intracranial occlusion of the internal carotid artery before it branched and ligated the ophthalmic vein, also resecting portions of the peri-orbital vein before satisfactory results were obtained. Adson found that no visual changes resulted from ligation of the ophthalmic vessels. If an arteriovenous aneurysm occurs in a patient with hypertension whose study demonstrates suitability for sympathetic surgery, he may have to be subjected to a combination of operations before a satisfactory result can be obtained. Preceding ligation of the internal carotid artery, it is of importance

to be certain that a hyperirritable carotid sinus is not present, for prolonged stimulation of the sinus might cause death at the time of operation. In preparing the patient for ligation of the artery, it is the practice to accustom him to occlusion of the artery by either digital compression or special clamps such as described by Light.[14] It is well, therefore, to start initial occlusion of the internal carotid artery cautiously with digital compression. If slowing of the pulse or syncope does not develop, it is safe gradually to increase the occlusion to thirty minutes three times daily before ligation is carried out. At the time of ligation cerebral ischemia should be prevented by keeping the blood pressure normal and the head below the heart level, continuing this for at least two postoperative days.

Carcinoma should usually be treated by roentgen therapy. At times, however, surgery may be used as a supplementary measure.

Sarcoma of neurogenic origin responds very little to roentgen therapy, and local excision transcranially is indicated. This is also true of the osteogenic sarcoma; however, roentgen therapy should supplement the excision.

The treatment of angioma depends on its extent. The arterial orbital angioma is usually encapsulated and can be removed safely and readily transcranially. The venous angioma should be removed transcranially by electrosurgery. The lymphangioma usually is associated with such extensive peri-orbital involvement that surgical treatment is not feasible, radium or roentgen therapy being the treatment of choice.

SUMMARY

A survey of the etiologic factors causing either bilateral or unilateral exophthalmos is given with a discussion of their management and results.

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GANGRENE OF THE FINGER FOLLOWING DIGITAL NERVE BLOCK

A REPORT OF EIGHT CASES WITH DISCUSSION OF THE GANGRENE PATHOGENESIS

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A DIGITAL nerve block with a local anesthetic solution is frequently used for the performance of minor surgical operations upon the fingers. The most popular anesthetic solution is 1 or 2 per cent procaine, with or without epinephrine. A skin wheal is raised on the dorsum of the base of the finger by injecting several drops of the anesthetic solution into the skin with a small calibre hypodermic needle. Through this wheal, the needle is inserted along the side of the phalanx and several cc. of the anesthetic solution are injected as the needle advances. The needle is withdrawn, and using the same skin wheal or a new one, the other side of the phalanx is injected. A tourniquet is often placed around the base of the finger in order to obtain a more rapid anesthesia. This technic is demonstrated in Figure 1.

Digital gangrene following the above type of nerve block has been reported very infrequently in the English literature. Garlock[1] first called attention to this complication in 1931 in a series of four cases. Kaufman,[2] in 1941, reported another case and reviewed the literature very completely. He called attention to the fact that this type of gangrene was frequently reported in the German and French literature. Since this time, two more cases have been reported by McLaughlin[3] and Pelner.[4] Altogether, thirty-two cases have been cited in the combined English and foreign literature. This would lead one to the conclusion that such gangrene is a very infrequent complication of digital nerve block. To prove that such is not the case, the following series of eight cases is reported and discussed. Table 1 presents a summary of these cases.

CASE REPORTS

CASE 1. M. K., a forty year old white married woman entered the Out-patient Department on May 9, 1938, with a localized abscess at the tip of her right index finger. A nerve block was performed and the abscess was incised. On returning home, she placed the finger in hot water. On the next day the finger became very swollen, and two days later large blebs were noted over the entire finger. These were débrided. The finger became worse and in about eight days the distal third of the finger was dark brown and anesthetic. The patient was admitted to the house on May 24, 1938, and warm soaks were applied to the finger. On June 1, 1938, under gas-ether anesthesia, the finger was amputated at the base of the gangrenous area, at the distal end of the proximal phalanx. The subsequent course was uneventful.

CASE II. S. S., a forty-one year old colored widow entered the Out-patient Department on August 2, 1935, with a paronychia of the right mid-finger. Nerve block anesthesia was performed at the base of the finger with novocain solution (? adrenalin). No tourniquet was used. The finger was incised and the patient went home and soaked her finger in warm water which "did not feel extremely hot." Following this in the morning, the finger began to swell to "twice its size" and the next day blebs appeared on the finger. Gentian violet ointment was then applied to the finger which gradually became worse with sloughing of the skin and subcutaneous tissue. The patient was admitted to the house on September 3, 1935, where the distal phalanx was found to be dry and shriveled and numb. On September 7, 1935, under ether anesthesia, an amputa-

tion was performed through the proximal phalanx. The subsequent course was uneventful.

Case III. L. A., a fifty-one year old Italian housewife entered the hospital on August 28, 1941, with a laceration over the distal interphalangeal joint on the palmar aspect, and a fracture of the middle phalanx. The laceration was about 1½ cm. long. A digital block was performed with 15 cc. of 2 per cent novocain solution without adrenalin. The laceration was irrigated and sutured. Six days later the entire finger was found to be swollen and the distal end was black and necrotic. The condition was treated with warm soaks. The patient refused amputation. On October 10, 1941, under pentothal anesthesia, amputation was performed through the mid-portion of the proximal phalanx. The subsequent course was uneventful.

Case IV. L. C., a fifty-six year old Jewish lady entered the Out-patient Department on August 15, 1938, with onychia of the right index finger. This was incised under nerve block anesthesia and it healed well. She entered again on September 10, 1938, with a chronic paronychia of the right index finger. On September 13, 1938, the base of the nail was removed under local nerve block. While the finger was still numb, she placed it in very hot water. The next day, "extensive burns" were noted over the entire index finger. On September 23rd, the patient was complaining of considerable pain in the finger and the distal portion was atrophied. She was admitted to the house on September 26, 1938, when the distal three fourths of the finger was found to be atrophied and black with the proximal portion red, swollen and tender. She was returned to the Out-patient Department for further treatment of the sepsis prior to amputation. The subsequent course is not known.

Case V. A. S., a forty-seven year old white, married female had tuberculosis in 1916 and went to a sanitarium for one year. On November 7, 1939, the patient received a splinter in her right fifth finger which she removed herself. However, the finger became painful and one week later a nerve block with novocain was

TABLE I

SUMMARY OF EIGHT CASES OF FINGER GANGRENE FOLLOWING DIGITAL NERVE BLOCK

Case	Sex	Age	Complaint	Amount Sol.	Epinephrine	Tourniquet	Soaks	Result
I	F	40	Localized small abscess-tip of rt. index finger	?	?	?	Hot water	Finger swollen next day with blebs. Distal third became black and atrophied. Amputation.
II	F	41	Paronychia rt. mid-finger	?	?	o	Warm water	Finger began to swell that night. Distal third became black and shriveled. Amputation.
III	F	51	Laceration distal interphalangeal jt. Fracture middle phalanx.	15 c.c.	o	o	.....	Distal end became black and necrotic. Amputation.
IV	F	56	Paronychia rt. index finger.	?	?	?	Very hot water	Next day—extensive burns over entire finger. Distal portion became black and atrophied.
V	F	47	Infected splinter wound	?	?	+	.....	Severe pain in the evening. Blebs and swelling next day. Distal half became black and hard.
VI	F	62	Paronychia rt. middle finger	4 c.c.	+	o	Comfortably warm water	Finger swollen and cyanotic next day. Distal phalanx became black. Amputation.
VII	F	42	Paronychia left mid-finger	?	+	o	Very hot	Finger swollen next morning. Distal half became black but in about a month, only terminal 1–2 cm. were lost.
VIII	M	59	Subungual hematoma left thumb.	?	?	?	Hot	Finger became swollen with blisters. Distal half turned black and atrophied. Amputation.

performed, using an elastic band for a tourniquet. The operation of incision and drainage lasted about three quarters of an hour. The patient was admitted to the house on February 8, 1943, where the finger was found to be "slightly swollen with a broken blister

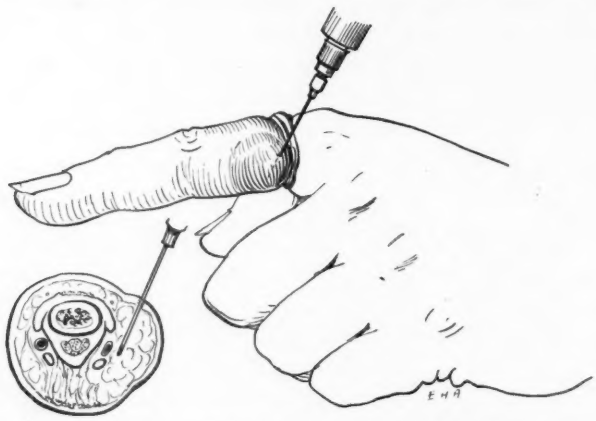

FIG. 1. A popular digital nerve block technic, demonstrating use of tourniquet. Cross section shows how digital artery may be compressed by the injected anesthetic solution.

patient suffered severe pain in that finger for the rest of the day and night. The next day, soaks were advised but the pain continued. The following day, the dressing was removed and numerous blisters were noted on the finger. These were opened and the finger was redressed. The pain continued and the patient entered the hospital on November 11, 1939. The distal phalanx plus one-half of the middle phalanx was "definitely black in appearance" and anesthetic. Demarcation continued and on December 2, 1939, the patient was discharged to the Out-patient Department for treatment of the finger prior to amputation. The patient was readmitted on May 6, 1940, when the proximal phalanx was black and hard. Amputation through the middle phalanx was performed and the subsequent course was uneventful.

CASE VI. C. D., a sixty-two year old lady entered the Out-patient Department on February 5, 1943, with a paronychia of her right middle finger which was incised under nerve block, using 4 cc. of a 2 per cent novocain-adrenalin solution with no tourniquet. She went home and soaked her finger in very warm water. This water was "comfortably warm." This procedure was done several times during the day. The next day she noticed the finger was swollen and very dark red and she returned to the Out-patient Department. Warm chlorinated soaks were continued but the finger became more swollen and blistered. The extending from the tip to the proximal portion of the middle phalanx." "The distal phalanx was black." The finger gradually began to demarcate at the center of the middle phalanx. (Fig. 2.) On February 29th, the terminal portion was hard, black and shriveled around the bone. On March 10, 1943, amputation was performed. A skin test with adrenalin and novocain on March 14th, revealed no abnormal sensitivity to these agents.

CASE VII. M. K., a forty-two year old white widow entered the Out-patient Department on January 15, 1943, with a paronychia of the left mid-finger which was incised and drained under nerve-block anesthesia, with novocain-adrenalin solution of an unspecified quantity. No tourniquet was used. The patient went home and, while the finger was still anesthetic, placed the entire hand in water "as hot as she could stand" for twenty minutes. This was continued every two hours for five soakings. The next morning, when the bandage was removed, the entire finger was swollen and the skin of the distal half was black. The finger was very painful. The rest of the hand was normal, with no erythema. The finger remained swollen and black for about a month and was treated with chlorinated soaks. Finally, the swelling subsided and the color became more normal until March 19, 1943, when there was a 2 cm. area of sloughing skin and subcutaneous tissue at the tip of the finger. The finger has motion of about 5 degrees in each joint

and the subcutaneous tissue of the entire digit is very much atrophied.

Case viii. J. O'C., a fifty-nine year old white male entered the Out-patient Department on November 6, 1935, with a subungual hematoma. Under novocain nerve-block anesthesia, this was incised and hot soaks were applied to the finger. The finger became swollen and numerous blisters appeared. In about a week, the distal half turned black and the patient was admitted to the house. On entry (December 5, 1935), he presented "hard, cold two distal phalanges of the left thumb." By December 25, 1935, the "end of the finger was cold, decreasing in size and the bone was visible." On January 1, 1936, under gas-oxygen-ether anesthesia, the terminal phalanx was amputated. Incidentally, this case in the Out-patient Department was treated with Gentian violet ointment following the discovery of the blisters and on entry the finger had an eschar around it.

COMMENTS

Gangrene of the fingers following nerve block is due either to a severe thermal damage which causes an irreparable tissue necrosis, or to a circulatory deficiency. Lambert and Snyers[5] believe that a third factor is at work, i.e., thrombophlebitis of the digital veins with secondary retrograde arterial obliteration, probably due to arterial spasm. They based their conclusion on the fact that edema and cyanosis, with no ensuing gangrene, follows local infiltration of novocain in experimental studies on a man's finger and on rabbits' ears. Such edema they attribute to venous stasis and not to arterial occlusion. However, if the circulation to a part is obliterated for a time, sufficient to cause capillary damage, severe edema and cyanosis will follow release of the obliteration as the blood flows through the damaged capillaries.[6,7,8] Pochin[38] investigated the edema produced in rabbit's ears by temporary ischemia and found the edema fluid to be rich in protein. Injection of Evans blue dye into the rabbits, prior to removal of the occlusion to the ear, resulted in the affected ears becoming blue as well as edematous. Samples of edema fluid were deeply colored. Both these findings demonstrate increased capillary permeability following ischemia.

Fig. 2. Digital gangrene following nerve block with 2 cc. of a novocain-adrenalin solution. Case vi.

There is thus no need for assuming that venous thrombosis must be present. Therefore, only factors relating to circulatory deficiency and thermal damage will be mentioned in this discussion.

CIRCULATORY DEFICIENCY

Epinephrine. The presence of vasoconstricting epinephrine in the anesthetic solution has been suspected of being a major factor in the development of the gangrene. Gangrene of other areas of the body following the local use of procaine-adrenalin solutions have been reported: abdominal wall (Gebele,[10] Koch[11]), scrotum (de Smeth[12]) and patella (Boerner,[13] Wagner[14]). In finger gangrene following digital nerve block, Kaufman[2] found it was used in 75 per cent of the cases in which its presence or absence could be determined. Pelner[4] and McLaughlin[3] reported its use in each of their cases. In this series, the presence or absence of the adrenalin in the anesthetic solution was determined in only three cases and in two of these, adrenalin was used (Cases vi and vii). However, the routine solution of novocain that is used in our Out-patient Department is 2 per cent novocain-epinephrine

solution and it may probably be correctly assumed that the majority, if not all, of the other cases was infiltrated with the novocain-epinephrine mixture.

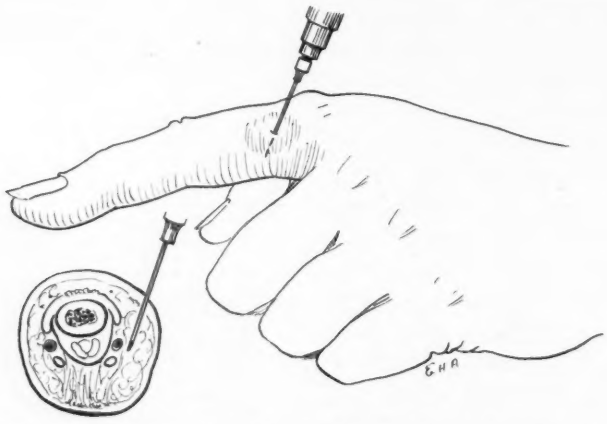

Fig. 3. Demonstration of nerve block using only 1 to 1½ cc. of anesthetic solution without adrenalin or use of tourniquet. Cross section shows that this amount of fluid should not compress digital artery.

Several animal experiments have been performed in order to throw some light on this question. Lambert and Snyers[5] sectioned rabbits' ears lengthwise so that each long segment had a nourishing artery. When the ears had healed, their bases were infiltrated with scurocaine solutions of various strengths, and with or without adrenalin. They found that in several hours the various segments became edematous and cyanotic, whether or not adrenalin was used. From the brief report of their experiment, it appears that the adrenalin may have produced more capillary anoxia, since the edema disappeared in twenty-four hours when 2 per cent scurocaine without adrenalin was used, and in forty-eight hours when adrenalin was used. Pelner[4] injected the bases of rats' tails with 1 cc. of procaine, or normal saline, with and without various concentrations of adrenalin, and found that gangrene of these tails never developed unless adrenalin was used, even if the concentration was as low as 1:100,000.

The majority of patients who receive procaine-epinephrine nerve block do not develop gangrene. Therefore, some observers believe that a hypersensitivity to adrenalin may cause an exaggerated response to the vasoconstrictor substance (Heinicke[15]). However, cutaneous tests by Makai[16] and Kaufman[2] were negative and, in Case VI of this series, a cutaneous test with 1:1,000 epinephrine solution revealed no abnormal sensitivity.

Cammer and Griffith[17] have suggested that adrenalin may have an effect on local tissues other than vasoconstriction. These authors have some experimental evidence to indicate that adrenalin decreases the oxygen utilization of tissues. Although this decrease is probably secondary to vasoconstriction, further investigation of this local tissue effect is indicated.

Thus there is good clinical evidence and some experimental evidence that the use of adrenalin in the anesthetic solution may cause sufficient vasoconstriction to produce gangrene. However, it must be remembered that procaine-adrenalin solutions are the most commonly employed. Hence accidents following their use should be reported more frequently. Besides, cases have been reported in which no adrenalin has been used (Siebert,[18] Moulonguet,[19] Delgoffe,[20] Dejardin[21]) and none was used in Case III of this series. Thus some other factors must be operating.

Tourniquets. Garlock was one of the first to attribute the digital gangrene to the use of a tourniquet at the base of the

finger. The tourniquet is dangerous because it markedly slows down the blood supply to the finger and produces local tissue damage at the site of the compression, thereby favoring arterial thrombosis. Garlock presented four such cases.[1] Individual cases of a tourniquet being used with subsequent gangrene have also been reported by Siebert,[18] Makai,[16] Lambert and Snyers[5] and McLaughlin.[2] In this series it was used in one of three cases in which its presence could be determined (Case v). Thus, the danger of using a tourniquet in such nerve block anesthesia is fairly well established.

Injected Fluid Mass. The subcutaneous tissue is not very spacious. It is easily apparent, from a glance at Figure 1, that even a few cc. of fluid will distend this space and hence compress the digital vessels. In some cases (Wolfsohn,[22] Rupp,[23] Delgoffe[20]) from 8 to 15 cc. of solution were injected around the base of the fingers. In Case III of this series, 15 cc. of novocain solution without adrenalin was used. Attempts have been made to obviate this lack of space by injecting the solution at different levels of the finger or between the metacarpal bones. However, gangrene has also followed this practice.[15,24]

Experimentally, edema and cyanosis followed the use of any fluid injected in Lambert and Snyers' experiments on the rabbits' ears.[5]

Thus, the mere presence of fluid at the base of the finger may interfere with the blood supply especially if used in large amounts or if used in patients with poor blood supply, such as older people with arteriosclerosis. Therefore, in performing the nerve block, only 1 to 1½ cc. of solution should be injected. This is demonstrated in Figure 3.

Miscellaneous Factors. It may happen that the digital arteries or veins may be severed with the hypodermic needle or injected with the needle and produce a thrombosis. No cases, however, have been found to demonstrate this.

In Case VIII of this series, the patient on entry to the hospital presented a finger with an eschar around it formed by Gentian violet ointment. This eschar may have embarrassed the circulation and, therefore, aided in the initiation of gangrene.

THERMAL DAMAGE

Upon studying the case histories of the patients with gangrenous fingers, it was discovered that warm or hot soaks had been applied to a great many of the cases. Since many of these fingers have been described as having severe burns, these soaks may have played a rôle in the gangrene production.

Very Hot Soaks. Temperature above 47°C. causes heat coagulation in the mammalian muscle (Allen[8]). Therefore, exposure of finger to heat above this level may be unfavorable. A finger placed in water at a scalding temperature (60° to 80°C.) will undergo severe tissue damage and may go on to gangrene even if there is normal digital circulation. Since the patient would ordinarily withdraw the finger from such a hot solution, this situation could occur only if the finger were still anesthetized. This probably occurred in the cases of McLaughlin,[3] Halla,[25] and Kaufman.[2] It may have occurred in Case IV of this series.

Hot Soaks. Fingers exposed to a temperature above 47°C. but below the scalding level are normally not damaged. This is the temperature of water which is subjectively described as "hot as one can stand." However, if there is a disturbance in the digital circulation so that the heat is not carried away from the finger, the normal temperature control is disturbed and the digital tissues would approach the level of their environment in proportion to the amount of circulatory embarrassment present. Schwan[26] reported a case of a finger with a contracture deformity which was subjected to novocain digital nerve block and subsequent dry heat. That night a black swelling occurred in the region of the injection which went on to gangrene and sloughing. This instigated an experi-

ment by I. Farben, in which rabbits' ears were subjected to a dry heat at above 60°C. In one series the bases of the ears were injected with several cc. of 2 per cent novocain, and in the other series no injections were made. Severe edema with ensuing gangrene always occurred in the injected ears. It is evident that in the non-injected ear, the circulation was sufficient to maintain the temperature of the tissues at a normal level, whereas in the injected ears, the disturbance in circulation prevented such temperature control and permitted the tissues to approach that of the surrounding air. Starr[27] reports similar experiences in legs, with arteriosclerotic occlusion, exposed to a heat cradle. Such a mechanism may have been present in Cases I, VI, and VII. The last case (Case VII) presents an experiment almost identical with Schwan's animal experiment. This patient soaked her entire hand in water "as hot as she could stand" for twenty minutes while the finger was still anesthetized. No change (erythema, vesicles, pain) occurred in the non-anesthetized digits, but the injected finger became swollen and black and the patient was extremely fortunate not to have lost the entire digit.

Warm Soaks. Temperature between 0°C., where freezing occurs, and 47°C., where coagulation occurs, affects tissues in several ways. First, it changes the blood flow to the affected part. Hewlett and van Zwaluwenburg,[28] by means of the plethysmograph, demonstrated that elevation of temperature to the body as a whole, produced increased circulation to an extremity, whereas cooling definitely decreased the circulation. This has been demonstrated several times since by Stewart,[29] Freeman[9] and Kunkel and Stead.[30] Second, increased temperature increases the metabolic rate of a tissue by speeding up the velocity of the tissue chemical reactions.[31–24] Thus, when heat is supplied to a tissue, the tissue metabolism is increased and the circulation is also increased to meet the metabolic needs. If, however, there is some obstruction to the circulation, metabolism will rise in excess of the circulation and the demand for oxygen and food and removal of waste products will be more than can be met by the circulation, and gangrene will result.[37]

Allen[6,7,8,35] was the first to face this problem experimentally. By ligating limbs and intestines of animals and exposing them to various temperatures, he found that slight elevations of temperature increased the incidence and onset of gangrene remarkably. Brooks and Duncan[36] reported similar experiments. When one considers that the high temperatures in Allen's and Brooks and Duncan's experiments which led to early gangrene were approximately 40° to 45°C., really that of comfortable warm water and below the critical muscle coagulation temperature, one wonders whether such factors enter into the pathogenesis of digital gangrene, following interference with the circulation due to the nerve block. Allen has noted the severe destructive changes caused by slight elevations of temperature. "The appearances rather strikingly resemble ordinary burns; particularly, the erythema, vesication and necrosis of limbs asphyxiated for a short time a little above 40°C. give an appearance which is scarcely distinguished from that of limbs dipped briefly into boiling water."[8] Thus, this increase in the digital tissue metabolism, in fingers with the circulation impaired by the novocain block, may lead to severe tissue damage and gangrene.

SUMMARY AND CONCLUSIONS

Eight cases of gangrene of the finger following digital nerve block are reported in order to demonstrate that this complication is not so infrequent as perusal of the literature would indicate. The pathogenesis of this complication has been discussed. It has been found that the injected solution may interfere with the digital circulation and produce gangrene, if first, too much solution is used, or second, if epinephrine is present in the solution or, third, if tourniquets are used. If the damage to the

circulation is not sufficient in itself to produce the gangrene, subsequent soaking of the finger in hot or even warm water may hasten devitalization of the tissue.

It is suggested that digital nerve block be replaced whenever possible by a general anesthesia using pentothal or gas-oxygen or ether. If it becomes necessary to use a local anesthesia, great care should be taken in performing the nerve block. No tourniquet nor solution containing adrenalin should be used. Only a small quantity of solution should be used, i.e., about 1 to 1½ cc. for the entire block. Soaks should be contraindicated for at least twenty-four hours.

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CHANGING CONCEPTS OF INGUINAL HERNIA

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INGUINAL hernia is probably one of the oldest lesions known to man, having been portrayed in the ancient art of Egypt and Greece. It is, therefore, quite natural that in the long ensuing span of time, viewpoints of the various phases of the subject should have gone through numerous cycles of interpretation. There are several reasons to account for this: (1) Misunderstood pathogenesis, (2) anatomical-physiological ignorance, (3) large percentage of postoperative recurrence, and (4) failure to recognize and apply the logical principles of treatment.

MISUNDERSTOOD PATHOGENESIS

The word "hernia" is derived from the Greek term meaning a branch or outgrowth, the ancients' conception of hernia. In the middle ages this belief was displaced by the one which considered hernia as a rupture or "*Bruch*" of some of the retaining structures, thus implying that all inguinal hernias were acquired. Later on, as the descent of the testicle was correlated with the potential causation, only those hernias were considered congenital in which the sac was part of, and continuous with the tunica vaginalis. The other types recognized were the encysted or infantile form and a hernia into the funicular process. This latter was the result of failure of closure of the upper pole of the tunica. The encysted form was the result of an additional attachment of the gubernaculum to that part of the peritoneum lying below and posterior to the peritoneum which normally forms the future tunica. Thus an additional pouch of the peritoneum is drawn down and eventually becomes encysted posterior to the true processus vaginalis. In case of operation, three distinct layers of peritoneum would have to be incised before entering the true hernial sac with its contents. This form must be very rare, very few being reported in the contemporaneous literature. It remained for the modern era to cut the Gordian Knot by considering all indirect inguinal hernias congenital at least as far as the sac is concerned, but with the understanding that a hernia is not considered such unless it contains abdominal contents. This might at first appear to be straddling the question were it not the only means of coordinating the concept of congenital origin with the question of trauma and compensability, which latter is such an important economic factor in our modern mechanical age; although it must be parenthetically stated that some compensation boards refuse to take this attitude and thus disallow compensation for hernia.

ANATOMICAL-PHYSIOLOGICAL IGNORANCE

Although an indirect inguinal hernia must first leave the abdomen through the deep ring, the latter is rarely evaluated and only occasionally dealt with operatively, irrespective of its large dimensions. On the other hand, an increased size of the superficial ring is stressed and pointed out as more important. In fact a large superficial ring through which an impulse on coughing may be felt has been considered a positive or potential hernia. Nothing is further from the truth. An impulse is always obtainable in every normal individual. Furthermore, a large diameter of the superficial ring does not favor the existence of a hernia any more than a large mouth will permit more food to pass down into the esophagus.

The embryological development, variations and trap-door function of the internal

oblique muscle has rarely been touched upon and only lately is being recognized. In the author's opinion, the proximity of this muscle to, and its defense of the deep ring is as important a factor as the persistent processus vaginalis. Even if the latter is patent and the deep ring moderately large, as long as the muscle is competent to act as a trap-door and thus prevent the abdominal contents from entering the ready made sac, no hernia will or can exist. Only the final and complete incompetency can explain the fact that two or three decades may intervene between birth and the first appearance of an indirect inguinal hernia.

Another structure, formerly neglected completely, has in the last few years been considered of major importance, viz., the transversalis fascia. Possibly the fact that it is covered by areolar tissue and that its strongest fibers lie posterior to the internal oblique muscle have been the causes of its neglect. Its cephalad portion, constituting the internal ring, and the caudad portion are of prime importance in the indirect and direct type, respectively.

The concept of the pathogenesis of direct inguinal hernia has remained more stable; it has been and still is acknowledged as an acquired lesion. The older anatomists stressed the fact of the division of the peritoneum in this region into three distinct fossae, any one of which could be a possible weakness and site of hernial origin. The boundaries of these are in the mid-line, the urachus, more laterally the obliterated hypogastric, and most laterally the deep epigastric vessels. A hernia through the middle of these was considered capable of emerging through the separated fibers of the conjoined tendon. This seems so improbable as to lead one to believe that the most caudad portion of the internal oblique muscle was erroneously mistaken and misnamed conjoined tendon. These two anatomical terms are still very loosely used in many operating rooms. But it must be remembered that the length of the conjoined tendon rarely exceeds three-quarters of an inch.

An anatomical enigma has been the proportion of one to four of direct to indirect primary hernias, inasmuch as Hasselbach's triangle, the site of the direct hernia is practically unprotected except by peritoneum and transversalis fascia. Equally inexplicable is the fact that postoperative recurrences appear much more frequently as the direct form even though the primary hernia had been of the indirect congenital type. Failure to recognize and thus traumatize the transversalis fascia at the primary operation may be a factor.

Though not generally recognized, there are two clinical-anatomical varieties of direct hernia: The one, the commoner, results from an attenuation and stretching of the overlying transversalis fascia; the other is represented by the extrusion of a definite pyriform sac through an artificial opening in this fascia. The practical significance of this differentiation lies in the fact that the former, never becoming strangulated, need not be operated; while the latter may and does become incarcerated and, therefore, must be operated upon.

RECURRENCE AND ILLOGICAL TREATMENT

It is reasonable to expect that in our present era of surgical progress one, two or at most three operative procedures have been generally approved and accepted. On the contrary more and more types and modifications of operations have been added to the unwieldy total. The foremost cause of this must be the high percentage of operative failures, much higher than generally believed and reported. The laity also knowing of this, could not be blamed for vainly grasping at a method (injection) portrayed so enthusiastically without the added discomfort and economic hindrance of hospitalization. In the pre-Pasteur days infection at operation was quite a common occurrence. Laudable pus was given credit for the formation of fibrous tissue which was considered the main factor in those cases which remained free of recurrence. In fact, one famous surgeon (McBurney)

packed all his hernia operations wide open with this in mind. But he abandoned this method as he recognized its fallacy very soon. The injection treatment is based upon this same fact of fibrous tissue formation; but as the research work of injecting sclerosing substances into muscle was erroneous and as the test of subjection to time has again proved its general failure, its use must be limited to the application of very few.

It is not difficult to understand some of the older operative procedures as they were based on an incorrect concept of pathogenesis. Removal of the total outgrowth, including skin, testicle and hernial contents put the accent on thoroughness but invited a directly proportionate mortality rate. Later on, a purse-string operation, inverting the scrotal skin and hernial contents was less gargantuan but equally ineffective. The use of a button of bone removed from the symphysis to act as a plug at the deep ring was at least a step forward in the understanding of some of the principles involved. The first real progress was in the elimination of the sac which is still the *sine qua non* of success. On the other hand the utilization of the cremasteric muscle and fascia (Halsted) never had any logical or physiological basis. The suture of the internal oblique muscle to Poupart's ligament (Bassini) was an epoch-making step forward and resulted in a tremendous improvement in the operative results. But its error lay in the claim that the procedure built up the floor of the inguinal canal—a repair that is neither justifiable nor necessary, as there is no floor weakness in an indirect hernia, the lesion being entirely at the internal ring. Furthermore, muscle structure functions by contraction and relaxation, not by fixation which can result only in atrophy, weakness and ultimate paralysis with the resultant recurrence often larger than the primary hernia.

Why imbrication of the external oblique aponeurosis was and still is so frequently done, is rather difficult to understand. It becomes tense when the external oblique muscle contracts and probably its main function, in addition to motion, is to protect the abdominal contents from external violence. It certainly does not prevent the emergence of viscera at either the deep or superficial ring. Imbrication merely foreshortens the structure, a result that could be obtained by excising a portion and resuturing the edges.

Formerly great importance was ascribed to transplantation of the cord, particularly subaponeurotically, sometimes even subcutaneously. It seems to the author that the disposition of the cord in an indirect hernia makes very little difference, inasmuch as the size of the deep ring and the status of the internal oblique muscle are the dominating factors. On the other hand, in a direct hernia, transplantation is imperative, as building up the roof of the hernia (floor of the canal) is essential and this can best be done by close approximation of the internal oblique *fascia* and Poupart's ligament.

The claim of some that the type of suture material is the all important factor in the cure of hernia, is only partially true. The whole question of suture material has strangely gone through a complete cycle. From the non-absorbable silver wire as used fifty years ago we are back again to the use of alloy steel. In the interim catgut, linen, fascia, silk, cotton and lately plastic material, have been advocated and tried. It seems to the writer that the individual material is of less importance than the method of application, with accent on absence of tension, proper knotting, minimum trauma from handling, tying or clamping, complete hemostasis, general and vitamin status. The healing process is inherent in the tissues, the sutures merely contact them during the lag period. The finer the suture and the less the tissue reaction, the better prospect of primary union; and this is distinctly the modern trend. But whether chromic gut No. 00, fine silk, steel alloy are preferable, will ultimately be proved. The one big disadvantage of most non-absorbable

material is the occasional ensuing sinus, in case of infection, with months of discharge until extrusion or removal of the offending material. Infection will occur in any large series in every hospital at least in 2 to 3 per cent of the cases.

The first step if we are to improve the situation is to relegate the subject to the importance it deserves, especially owing to its common occurrence (5 per cent total population). It merits care, consideration and operation by the more mature members of the operative staff, and not as hitherto considered, by those of the house surgeon's realm. We must realize that the indirect and direct variety are two distinct entities and must, therefore, be treated differently. The introduction of some minor technical modification must be supplanted by a study, interpretation and application of physiologic-mechanical problems predicated upon increased anatomical knowledge.

The author's operations[1,2] for indirect and direct inguinal hernia are based on these factors. For the first type, elimination of the sac, narrowing of the lumen of the internal ring and placing the internal oblique muscle in a position so that its trap-door function can protect the internal ring. For the second type, the lower part of the transversalis fascia is reinforced, utilizing the internal oblique fascia, particularly at the pubic spine. Absence of tension is imperative in all types.

Recurrences with this type of operation are as follows:

Primary:

Indirect: 1.4 per cent
82 hernioplastics, 71 follow-up,
1 recurrence
Direct: 11.7 per cent
43 hernioplasties, 30 follow-up,
4 recurrences
Indirect-direct: 12.5 per cent
11 hernioplasties, 8 follow up,
1 recurrence

Secondary:

Indirect: .0 per cent
Direct: 7.4 per cent
17 hernioplasties, 14 follow-up
1 recurrence

As each individual is subject to anatomic-physiologic variations, some beyond correction, even the proper application of the correct principle will not necessarily give 100 per cent results. However, if we can approach that goal by steady improvement, our efforts should be encouraged and continued.

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ACUTE NONSPECIFIC MESENTERIC ADENITIS

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THIS disease has become a clinical entity during the past twenty years and has recently received considerable attention and study concerning etiology, physiology, pathology and attempt at diagnosis preoperatively. Even though exhaustive investigation has been done, considerable information is lacking, particularly as to cause and ability to diagnose the lesion definitely in order that surgery might be avoided in most instances. The purpose of this report is to continue to express the importance of the lesion and to point out how it is as yet impossible to diagnose the lesion definitely without laparotomy.

The lymph glands of the abdomen are divided into parietal and visceral groups. The visceral glands are associated with the branches of the celiac, superior and inferior mesenteric arteries. The superior mesenteric glands are divided into mesenteric, ileocolic and mesocolic groups. The mesenteric glands lie between the layers of the mesentery and vary between 100 and 150 in number.

The ileocolic glands, involved in mesenteric adenitis due to the close proximity of the appendix and ileum, number from ten to twenty and form a chain around the ileocolic artery and are grouped into ileal, anterior ileocolic and posterior ileocolic.

The lymphatic vessels of the ileum are termed lacteals and run between the layers of the mesentery and enter the mesenteric glands, the efferents of which end in the pre-aortic glands.

The lymphatic vessels of the appendix are numerous. From the body and tail of the vermiform process eight to five vessels ascend between the layers of the mesentery, one or two being interrupted in the gland which lies between the layers of this peritoneal fold. They unite and end partly in the upper glands and partly in the lower glands of the ileocolic chain. Wilensky has stated that since the lymph drainage of the appendix is such only a congenital absence of such drainage will produce mesenteric adenitis from involvement of the appendix.

The nerve supply to the mesentery attached to the ileum is by means of the superior mesenteric plexus. This plexus also supplies the pancreas, other portions of the small intestine and the ascending and transverse colon. The appendix is supplied as is the small intestine by a secondary network of plexuses termed Auerbach's plexus and Meissner's plexus. It may be due to such nerve supply that pain referred from the ileum region, would account for varied areas of abdominal pain in mesenteric adenitis.

The clinical significance of acute mesenteric adenitis is of recent origin. Murphy made note of enlarged glands in 1908 but it was not until 1924 that Noesske urged inspection of the glands in abdominal pain of unknown origin.

From the eighty-four reported cases in this series thirty-five patients were not operated upon, leaving a surgical series of forty-nine cases. The thirty-five non-surgical patients recovered in one to five days. One patient was discharged in three days and returned in one week with a diagnosis of perforated appendix with abscess formation following which an appendectomy was done in two months, at which time the appendix was firmly bound down by adhesions.

The age in this series varied from three to sixty-five years of age; 18 per cent were

below ten years and 51 per cent were ten to twenty years of age; only 4 per cent were above thirty years. This age group coincides with Postlethwait's study of 771 cases and also coincides with Slattery's and Hinton's survey on appendicitis, in which the second and third decades are most common periods.

No correlation as to season could be determined as the greatest months were January 12 per cent, August 20 per cent, September 13 per cent, and November 12 per cent, with October and December intervening with 3.5 and 4 per cent, respectively.

This study concurs with Tilley who reported sixty-nine cases and stated respiratory infection is inconstant. There was a history of preceding respiratory disease in 37 per cent of this series.

Sex incidence in this series was 38 per cent females and 62 per cent males in comparison with Postlethwait's collected series of 771 cases in which there were 44.6 per cent males and 55.4 per cent females. His own cases were 59 per cent males, which compares favorably to this study.

Fifty per cent had symptoms twenty-four hours or less and only 12 per cent had symptoms longer than seventy-two hours. In Slattery and Hinton's review, the average duration for acute appendicitis was twenty-nine to thirty-nine hours and forty-eight to fifty-four hours for localized peritonitis following perforation. Twenty-five per cent of the appendicitis series had a history of previous attacks of abdominal pain as did this series of mesenteric adenitis.

The temperature was below 101°F. in 71.5 per cent of the cases and the appendicular series study had an average of 100.8°F., thus this factor is of no value in differentiation of the two lesions. 9.5 per cent had temperatures of 102° to 104°F. and Postlethwait reports 16 per cent with temperatures of 102° to 104°F.

Nausea and vomiting occurred in 73 per cent and 43 per cent had onset of pain in the right lower quadrant. The pain was of severe character in 21 per cent and cramp-like in nature in 65 per cent. Tilley states that pain and soreness is prominent in mesenteric adenitis, while Slattery and Hinton state that nausea and vomiting are more important than pain in appendicitis. Thirty-six per cent of Tilley's patients had onset of pain in the right lower quadrant which is usually against appendicitis. In this series 43 per cent had localized pain in the right lower quadrant, the other sites being general abdominal, umbilical, left lower quadrant and right upper quadrant.

Diarrhea and constipation are variable and not reliable symptoms.

In an appendicitis study 84 per cent had an average of 14,400 leucocyte count and 14.8 per cent had normal blood counts. This study revealed five counts of 20,000 or over, the highest being 24,600, and 30 per cent had 10,000 or less with an average leucocyte count of 11,700 with polymorphonuclears varying from 69 to 92 per cent. Postlethwait reports an average of 15,600 leucocytes. Thus it is not possible to differentiate mesenteric adenitis definitely from appendicular lesions by blood counts.

There were ten cases of acute appendicular obstructions in the series of eighty-four cases and one case of regional ileitis. Tilley reported eleven cases out of sixty-nine with appendicular lesions and stated most cases had injection of the terminal ileum and that free fluid in the peritoneal cavity was almost a routine finding, only six out of forty-four in Postlethwait's series had excess fluid and only three of this series were recorded.

The description of glands were hyperemic and grayish white varying in number from one and two to several; they also varied in size. It is estimated that any mesenteric gland larger than 0.5 cm. is diseased.

The postoperative course is not always asymptomatic as has been stated and distention and persistent abdominal pain are frequently present.

From available evidence it appears that the majority of cases are the result of the absorption from the lymphatic tissue of the ileum of bacteria, their toxins and other decomposition products. It has been suggested that spasm of the ileum is the most likely cause of pain rather than swelling and tightness of the peritoneal covering over the enlarged glands.

The following organisms have been cultured from excised glands: Bacillus coli, hemolytic streptococci, Bacillus aerogenes, and hemolytic staphylococcus. Positive cultures were obtained in only two out of forty-four cases in one series.

No deaths occurred in this series but fatalities have occurred from peritonitis secondary to suppurative mesenteric adenitis.

CONCLUSION

Because the temperature, clinical course, signs, symptoms and blood studies of mesenteric adenitis resemble those of appendicular lesions and also because there is a possibility of suppurative glands perforating with resultant peritonitis, laparotomy should remain the procedure of choice to verify the diagnosis.

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ASEPTIC RESECTION AND ANASTOMOSIS OF THE* SMALL INTESTINE

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A METHOD of intestinal anastomosis developed in the experimental laboratory and previously reported has been modified and employed in clinical cases with satisfactory results.

An effort has been made to reduce the technic to its ultimate simplicity while still maintaining the fundamental principles of intestinal surgery. The method was especially devised for the small intestine, taking into consideration the caliber of the bowel, the character of the mesenteric attachment and the histological components of the intestinal wall.

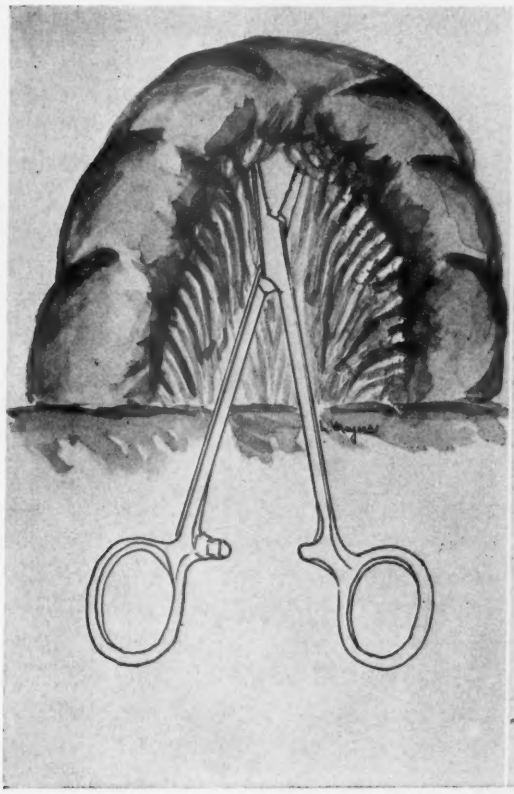

FIG. 1. This illustration shows the manner in which the mosquito forceps is pushed through the mesentery adjacent to the bowel at the level at which resection is to be done. Through this opening one arm of the Kocher forceps is inserted and the bowel is clamped.

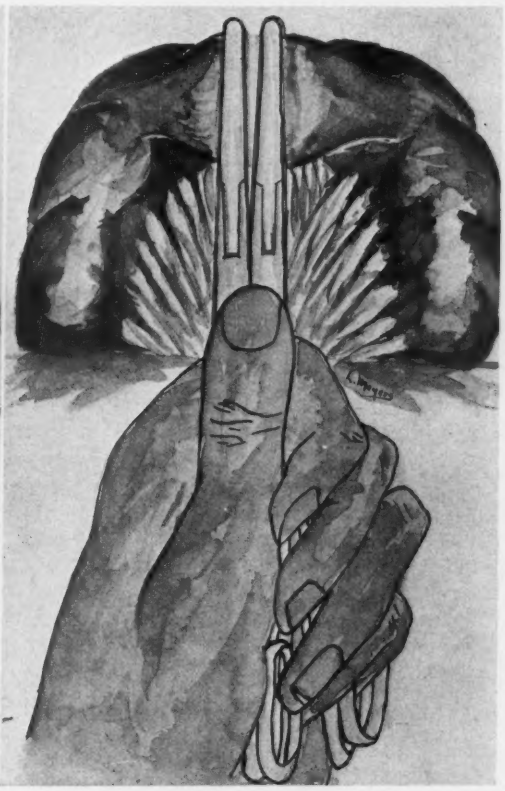

FIG. 2. Bowel ends are shown within grasp of Kocher forceps. The antimesenteric aspect of the bowel presents. The method by which the hand may hold the forceps satisfactorily stabilized is shown.

The technic to be described is considered advantageous for the following reasons: (1) It is relatively atraumatic; (2) it is relatively aseptic; (3) the procedure is safe as it permits accurate suturing, eliminates the "mesenteric angle," gives adequate serous apposition and is hemostatic.

Armamentarium. Kocher forceps serve quite satisfactorily as anastomotic clamps.

* From the Department of Surgery, College of Medical Evangelists.

A straight two-inch Mayo intestinal needle, Halsted mosquito forceps, chromic catgut No. 0 on a straight swaged needle and

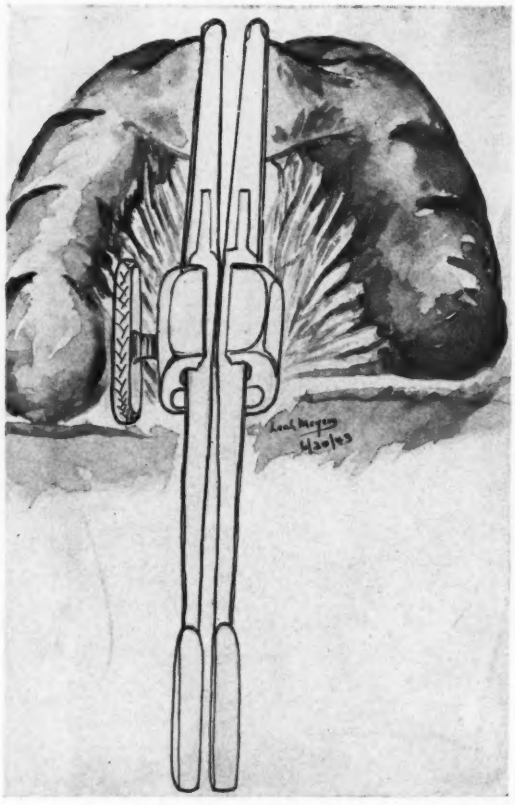

Fig. 3. Kocher forceps are shown within grasp of holding clamp which gives added stability.

Pagenstecher linen complete the list. A special holding clamp was devised to stabilize the forceps but when it is not available the forceps may be held in the hand in such a manner as to be quite stable.

Procedure. It is well to note that logical sequence in the successive steps of the procedure makes for simplicity. The point of a Halsted mosquito forceps is pushed through the mesentery adjacent to the bowel at the level at which the resection is to be done. The bowel is then crushed with a Kocher forceps by inserting one arm of the blade through the opening and clamping the bowel in such a manner that the mesenteric border is placed midway in the crushed area with the edges free of mesentery. The bowel is now cut through with cautery or knife. In the latter instance the application of phenol and alcohol is necessary.

The two forceps grasping the bowel ends to be anastomosed are placed side by side in the special holding clamp or hand, in such a manner as to stabilize the forceps and hold them in correct position for suturing. The forceps are then rotated through 180° vertical and turned through 180° horizontal in order to present the mesenteric borders up and the handles of the forceps toward the body of the operator.

The removal of the mesenteric attachment from the site of the future suture line is accomplished as follows: The mesentery of each bowel segment adjacent to the crushing forceps is clamped with a mosquito forceps, cut with a sharp knife from the grasp of the blades and pushed back far enough to enable placing sutures in the bowel wall completely free of mesenteric fat. The portion of mesentery caught by the mosquito forceps is ligated in order to insure hemostasis. This procedure is considered superior to the method of removal of the mesenteric attachment before application of the crushing forceps because the mesentery in the area to be denuded is held stabilized by the forceps and can be more accurately and completely removed from the bowel wall, and the necessary amount of bowel to be freed of mesentery can be accurately judged.

For suturing, a two-inch straight intestinal needle is preferred to the curved, as one may better gauge the depth of penetration, more certainly insure catching the submucosa and avoid entering the intestinal lumen.

The forceps are held in one hand and suturing performed with the other. The continuous suture of chromic catgut No. 0 is started at the far end of the bowel segment with the first insertion of the needle being taken in the direction of the long axis of the bowel. The remaining stitches except the last one are taken as a right angle Cushing suture. The last insertion of the needle is taken parallel with the long axis of the bowel and on the same bowel segment from which the suture was started. Beginning and ending the suture with

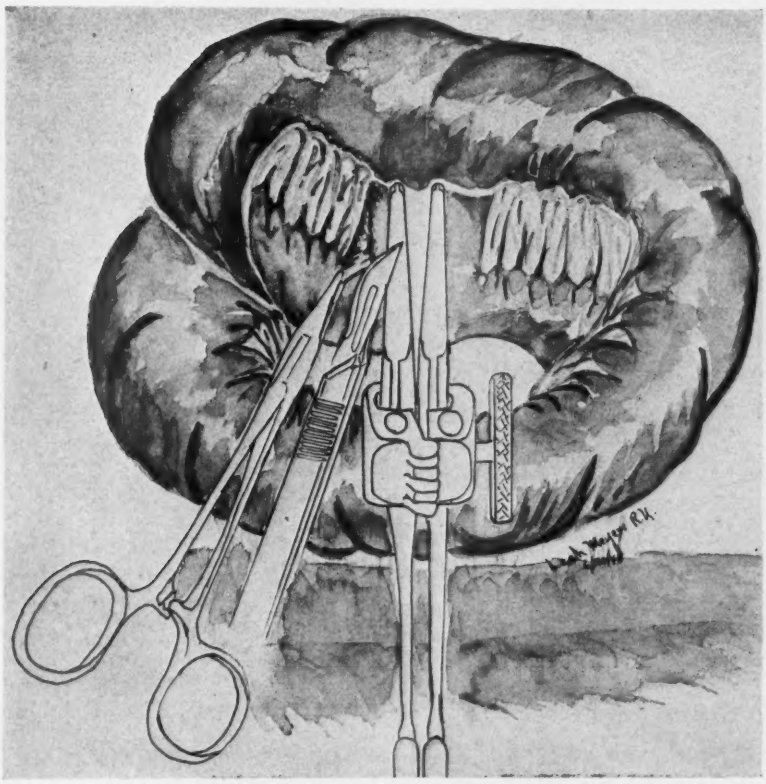

Fig. 4. The mesenteric aspect of the bowel presents after the forceps have been rotated through 180 degrees vertically and turned through 180 degrees horizontally. This view shows that the bowel has been clamped in such a manner that the mesenteric border is midway in the clamped area and well away from the bowel periphery adjacent to the forceps. The mesenteric attachment is shown stripped back for a distance sufficient to allow accurate insertion of sutures.

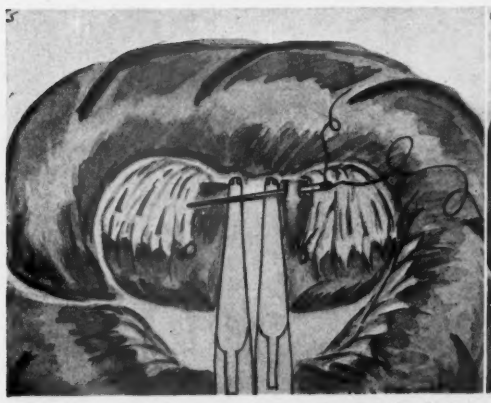

Fig. 5. This view shows the beginning of the right angle continuous suture on the mesenteric aspect with the first insertion of the needle being taken in the direction of the long axis of the bowel.

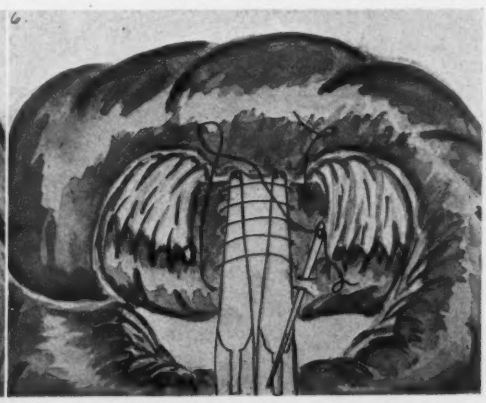

Fig. 6. This view shows continuation as a right angle suture with the stitches taken parallel with the forceps.

stitches parallel to the long axis of the bowel will make secure the angles at which the two continuous suture ends are tied be-

Fig. 7. This view shows the right angle continuous suture being completed on the mesenteric aspect of the bowel. Note that the last insertion of the needle is taken parallel with the long axis of the bowel and on the same bowel segment from which the suture was started.

cause there will be enough inversion of tissue to approximate serosa to serosa securely without undue encroachment on the lumen.

Beginning and ending the suture on the same bowel segment allows for accurate approximation of the opposing bowel ends when the two sutures are drawn taut preliminary to tying.

After completion of the suture on the mesenteric aspect of the bowel, the forceps are rotated vertically and turned horizontally so that the opposite side of the bowel, its antimesenteric aspect, presents and a similar suture is placed on this side with the stitch beginning and ending on the opposite bowel segment. As the bowel segments change position after rotation and turning, the suture is naturally started from the same relative position. After the forceps have been unlocked and removed the sutures are pulled taut, inverting the crushed bowel ends, and are tied tightly enough to cause slight inversion without constricting the lumen.

In completion of the anastomosis, the tied ends of the continuous right angle suture are buried with Halsted mattress sutures of Pagenstecher linen and reinforcing mattress sutures are placed around the entire periphery to complete the two layer anastomosis.

With only slight variation either side-to-side or end-to-side anastomosis may be performed as an aseptic procedure using essentially the same technic.

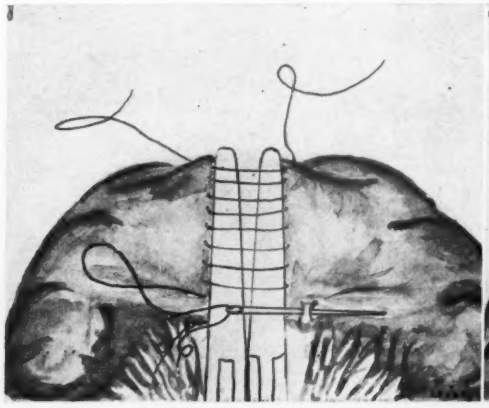

Fig. 8. Re-rotation and returning of the forceps has presented the antimesenteric aspect of the bowel in correct position for suturing. This view shows the suture completed. Note ends of sutures on opposite bowel segments.

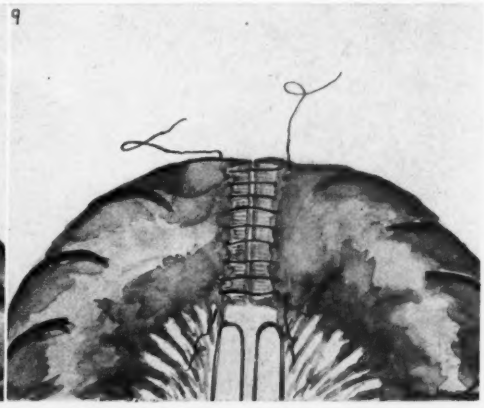

Fig. 9. Continuous sutures completed and forceps unlocked and withdrawn.

COMMENT

The manner of applying the forceps is considered important. It is difficult to place sutures accurately at the mesenteric angle when the usual method is employed, namely, that of applying the forceps so that the tips present at the mesenteric border.

When the forceps are applied so that the mesenteric border is midway in the crushed areas, it enables one to strip the mesentery back the required distance completely, so

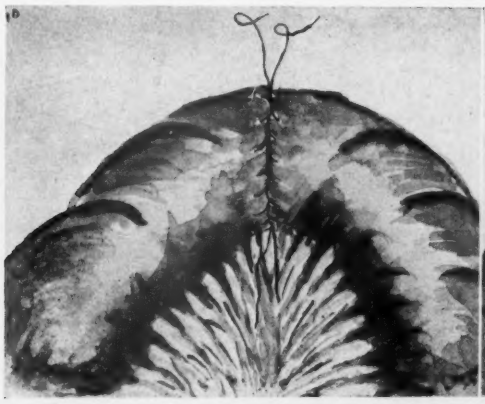

FIG. 10. Continuous sutures pulled taut and tied.

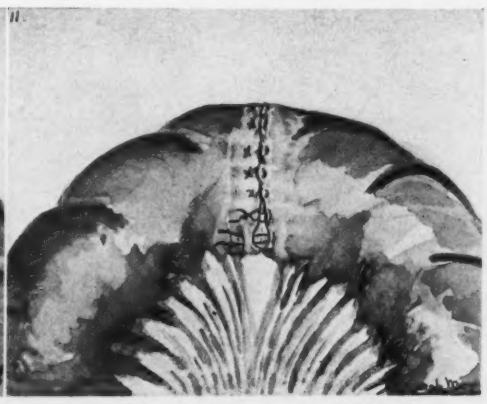

FIG. 11. Reinforcing interrupted mattress sutures placed around entire periphery.

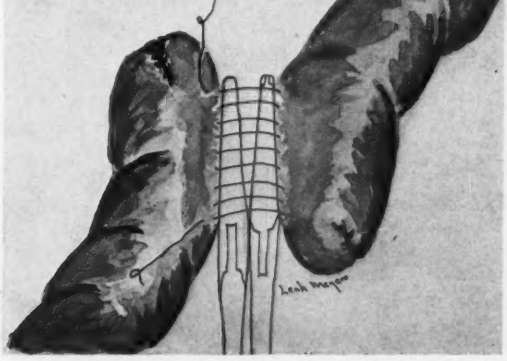

FIG. 12. This view shows method of placing continuous suture in side-to-side anastomosis. Note that suture begins and ends at right angles to the forceps and on the same bowel segment.

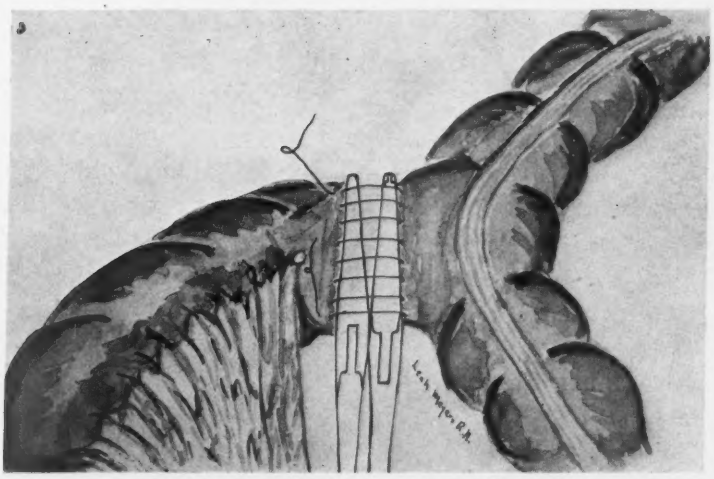

FIG. 13. This view shows method of placing continuous suture in end-to-side anastomosis. Note that suture begins and ends with stitches taken parallel with long axis of small bowel. The opposite suture should begin and end on the large bowel with the first and last stitch taken at right angles to the forceps.

that each suture may be accurately placed and eliminates entirely the "mesenteric angle" which in the ordinary type of anastomosis is the area most vulnerable to leak. This procedure likewise removes the point at which the two continuous suture ends are tied from the site of mesenteric attachment.

In a perusal of the recent literature on intestinal anastomosis, I have been impressed with the failure to stress a most important consideration which any satisfactory technic should include and the lack of which I believe is responsible for a definite percentage of fatal technical errors, namely, the necessity of including the submucosa within the bite of the needle in order to insure a suture that will give stability and holding power. It was Halsted who first called attention to this important fact.

In experimental work I have repeatedly been impressed with the sensation of "lack of resistance" which one obtains when only the serosa and muscularis are included in the stitch and conversely the "sense of security" when the submucosa is firmly caught.

It should be noted that if each stitch of the continuous suture is taken close to the well stabilized forceps, it will aid in accurate suturing as well as insure a minimum diaphragm of infolded tissue and still give adequate serous approximation.

In all cases of strangulation obstruction of comparatively short duration requiring resection, in which the bowel proximal to the strangulated loop has not suffered the changes incident to a long continued simple obstruction, as well as in the case of other pathological conditions which require resection, end-to-end aseptic anastomosis is the procedure of choice. Moderate edema of the proximal bowel segment is not a contraindication nor is moderate discrepancy in size of the two bowel ends.

Following obstruction of longer duration with pronounced edema of the proximal bowel and the presence of marked discrepancy in the size of the two bowel segments side-to-side anastomosis is indicated.

SUMMARY

A simplified technic of aseptic anastomosis is described which stresses fundamental principles in surgery of the small intestine. Special emphasis is given to the method of clamping the bowel in relation to the mesenteric border and the method of stripping the mesentery free from the proposed line of anastomosis. An important feature of the technic is elimination of the "mesenteric angle." The importance of including a portion of the submucosa with each stitch of the continuous suture is emphasized. The advantage of beginning and ending the continuous suture on the same bowel segment with stitches parallel to long axis of bowel is explained.

PILONIDAL SINUS OR CYST—A MISNOMER

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WHAT appears to be the earliest appellation of that anatomical anomaly or developmental embryonic fault known as a pilonidal cyst or sinus, as such, and more recently referred to as a sacrococcygeal cyst or sinus was made by Warren in 1847. A detached analysis of both these terms from the perspective of embryology, pathology, anatomical location, present common designation and medical literature will influence many of us to consider these names both misleading and inadequate, and in particular the term, pilonidal, a misnomer.

Hubley R. Owen[1] referred in his paper on pilonidal sinuses to an oral cummunication on this subject that the author had made to him in 1934. At that time the writer stressed the need for a new and more descriptive term not based solely upon the anatomical location, but also from an embryological or germinal layer basis that would include both the cause and location. Also this appellation should make provision for the type of lesion and the degree of involvement in order that the stage of completeness or incompleteness and inflammatory change as it actually exists when treated or operated upon may be stated. Such a descriptive terminology might result in a more lucid and comprehensive compilation of statistics on this subject and insure a more logical and rational evaluation of the surgical treatment.

Persistence in the continued use of these terms and the present method of reporting operative statistics and postoperative results will continue to foster misleading surgical information. Also, the present generalized grouping of all the varying degrees of these pathologic entities permits no differentiation as to the character, degree or extent. This loose and all inclusive method will continue to contribute to erroneous and controversial statistics and information concerning the end results of treatment until such time as a new, clearer and more explicit embryologic, anatomic and pathologic appellation is adopted.

The very term, pilonidal, derived as it is from conjoining the words "pilus," meaning hair, and "nidus," meaning a nest or a nest of hair (in a sinus or cyst), defeats by itself a proper description of itself. Personal observation over a period of years of many individuals with this condition, coupled with extensive reading and discussion of this subject with other physicians, has forced the conclusion that an attempt should be made to persuade the medical profession to adopt a more explanatory terminology. In the author's series of 132 cases, the anomaly in only four patients, slightly over 3 per cent, contained hair or a history of hair content was obtained. Other reported series have shown a much higher rate, and the greater proportion of reports have not even mentioned the presence or absence of hair. Compilation of several thousand case reports collected from various hospitals and literature averages less than 5 per cent but will vary decidedly in the same number of cases reported from other areas. The same situation unquestionably exists relative to the reported and unreported postoperative results.

Some difference of opinion exists about the etiologic theories concerning these pathologic occurrences. That these cysts and/or sinuses are epithelial lined is beyond question of reasonable doubt. That they are congenital also is beyond question. That they are always hair bearing and sacral or coccygeal in location is definitely questionable. Some authorities on pathology do not even deign to mention pilonidal or sacrococcygeal sinuses or cysts in their textbooks and with good

reason, in as much as they may be classified pathologically as dermoids of varying degrees.

Some authors have maintained that embryologically these tracts are the incompletely obliterated remains of varying degree of the lower portion of the neural canal. Others have apparently demonstrated that the cause is due to invagination and inclusion of the surface epithelium during the first three or four months of embryonic life, and in substantiation a connection has been shown through the sacrum with the neural canal causing mennigeal irritation, inflammation and infection as cited by Walker and Bucy.[2] It is held forth that the tract is the result of improper separation of the neural tube from the neural groove. Stone,[3] in 1924, described the coccygeal fistula as such and also offered the very intriguing and ingenious suggestion that these tracts presented a structural analogy to the preen gland of birds. The preen gland is a definite avian component and its function well understood, but embryologically and pathologically the analogy cannot be substantiated. It is true that the preen gland is always situated in approximately the same relative anatomical location and so are the sacrococcygeal sinuses, cysts and dimples. However, similar structures are found also in other parts of the human economy far removed from this area where the pathologic picture is fundamentally the same as portrayed in the sacrococcygeal area.

The author does not consider that troublesome activation usually occurring between the ages of seventeen and twenty-five is indicative of glandular causation as has been suggested at various times. The fact that this age group usually embraces the years of utmost physical activity and irritation of the sacrococcygeal area may be more significant. Everyone familiar with the formation of the embryo needs but to recall the various infoldings and fusions of the early days of the fetus finally resulting in the formation of anterior and posterior raphes. How simple it is for a small cell or rest of the epithelial layer to be included in, or pinched off by these infoldings and lie dormant until, under proper stimulation or irritation, it begins to grow and function in a foreign manner.

As mentioned before, reports have been presented from time to time of similar and identical pathological conditions occurring in other areas of the body, doubtless less frequently and less subject to irritation and constant trauma. P. A. McCarthy has verbally stated that he is aware of several of these occurring in the sternal region. The author has seen one case located in the region of the manubrium sterni in the female. This consisted of a tract about one inch deep, containing several small hairs, but it caused no trouble until about the age of thirty-two. At that time it became inflamed and started discharging.

Hagen[4] described one on the dorsum of the nose that included hair. This kind sometimes extends through the nasal bone in the anterior line. J. B. Ludy,[5] of Philadelphia, has shown some similar in structure, one in particular occurring in the midline of the lower lip, possibly due to improper fetal closure of the lateral halves of the mandible. This is not a common finding in cases of harelip and cleft palate, but it does occur. Some of these even discharge mucus.

No one can deny the presence of urachal cysts and sinuses presenting, at times, inflammation and discharge, and betraying faulty closures. Almost every urologist has seen perineal fistulas occurring anywhere from the tip of the penile opening to the anus and usually in the raphe itself. In fact, the burden of proof and occurrence places almost all these conditions in the raphe or fusion line, no matter in what part of the body they are located. These could readily and more descriptively be termed raphe (epithelial) inclusions. This term would serve to classify them immediately, whether or not hair is contained and regardless of anatomical location; but the latter could be added as a sacral or coccygeal or sternal raphe (epithelial) inclusion.

The tracts then could be further and more simply classified as within the following categories of developmental fusion according to degree as: (1) Complete, i.e., those that failed completely to close, resulting in a sinus; (2) partial, i.e., those that failed partly to close, resulting in a cyst or cysts with or without a sinus or sinuses; (3) incomplete, i.e., those that closed almost completely, resulting in a dimple or small recess. Pathologically any of these may or may not contain hair and may be further classified as: (1) asymptomatic, (2) symptomatic.

SUMMARY

1. The present appellation of pilonidal or sacro-coccygeal cyst or sinus is unsatisfactory.

2. The present statistical method of reporting end results of operative procedure is misleading.

3. The lack of a clearer classification leads to confusion and doubt. Under the present system of general inclusiveness, one series of cases may present such extraordinary end results of operation that another group may attempt the same type of healing in an entirely different type of involvement with disastrous and discouraging results, and thus be influenced in discarding or destroying a perfect means of healing for another degree of disorder.

4. A clear appellation may serve to clarify the present dissension and subjugate the controversial issue between packing the extirpated area to heal from the bottom up or closing to heal by primary union, thus permitting a better estimation of operative end results.

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RESTORATION OF FACIAL CONTOUR IN SURGERY OF THE SECONDARY CLEFT LIP AND PALATE*

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THE importance of restoration of normal contours in facial deformities is now recognized not only by the surgeon, but by the psychologist as well. That facial disfigurement plays an important rôle in the production of psychoneurosis of various kinds has been proved in many instances. The adult may suffer both socially and economically to the point of complete mental derangement. Maladjustment, self-consciousness, frustration and depression are the usual sequelae of facial deformities. Acquired deformities more often create mental distress in adults than those which are congenital. Sometimes the victim of an accident is rendered temporarily unstable by the sudden shock of facing disfigurement for life. With the development of the machine age and the keen competition of individuals in their struggle for success, personal appearance plays too important a part in our daily program to be taken lightly.

In children, disfigurements attract the attention of all. Grown-ups are excited to pity, disgust or horror by deformed children. On the other hand, the child's playmates react in a different manner. Their curiosity is aroused and remarks passed publicly to ridicule or embarrass the victim are the rule rather than not. Children are unfortunately cruel to others less favored than themselves, little realizing what feeling of inferiority and depression they are creating in the minds of their playmates. This attitude is particularly manifest in congenital cleft lip and palate deformities, in which in addition to disfigurement, abnormalities in speech are present. The dread of ridicule and mocking during recitation in school is often enough to cower the most courageous little soul and mark him as a thing apart. Even though he may have mastered his lessons, his oral delivery and his appearance are obstacles too great to hurdle. As a result he becomes self-conscious, increasingly sensitive and maladjusted to his environment. As he grows older his mental attitude may so change that he becomes an economic and a social failure.

With these facts in mind, it becomes the duty of every surgeon who undertakes the correction of these deformities to see not only the immediate result, but the future development as well. A great surgeon once said aptly that there is no end to plastic surgery—another operation can always be done. This was in criticism of a series of operations advised by the author for the restoration of a more normal facial contour in the case of an old, badly operated hare-lip and cleft palate. The improvement after the series more than justified the undertaking and resulted in very advantageous economic and social advances.

The patients primarily selected for attention are those which have been operated upon in infancy or childhood and have an apparent disproportion in growth between the mandible and the maxillae. The maxillae are small, the mandible protrudes, the upper teeth are either crowded into the palate or partially lost through decay. The upper lip is scarred, flat and tightly bound down. It is usually out of all proportion to the lower lip. The accom-

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panying nasal deformity only increases the general irregularity of facial contour. The lip may be closed, the anterior part of the palate may be closed, but neither the lip nor the palate may be rated 25 per cent functional, and the individual may be miserably conscious of his deformities. Speech is badly impaired. Due to the disproportion in the maxilla-mandibular relationship, the lips are unable to meet in properly controlled labial, labiodental, linguodental and anterior linguopalatal sounds. Even the two consonant sounds of "m" and "n" which most cleft palate patients can pronounce intelligibly are difficult. The explosive labials "p," "b," "f," and "v" are almost impossibly rendered, while the "wh" and "w" are distorted into nasals. The anterior linguopalatals, "s," "z," "zh," "sh," etc., require an impediment in the breath column which cannot function with an abnormal palate, lip and jaw relationship. The problem thus becomes one, not only of restored contour but also one which involves function as well. The restoration of function will follow if proper contour is feasible. Speech training must follow the operative procedures. It must be remembered that these patients have developed a form of speech entirely at variance with the normal. The normal resonance and the natural melodious inflections of voice are entirely lost and defective substitutes of nasopharyngeal phonation is established.

Here then is a type of disfigurement which calls forth both vision and ingenuity if a result warranting the expenditure of effort and sacrifice is to be obtained. If the surgeon is planning a repair of this type would consider it from the standpoint of an old healed injury rather than accept it as a congenital deformity for which a great deal has been done, much of the reconstructive plan could be seen in an entirely different light. The face must be theoretically taken apart and analyzed from an artistic and esthetic viewpoint, and a plan evolved which will create a rehabilitated individual raised to the status of a useful, happy being who can take his place as a normal citizen with the stigma of deformity removed. This may sound like a challenge, but much can be done if the problem is met intelligently.

In reviewing these cases certain characteristics are outstanding:

The Lips. Upon examination we find a narrow, tightly bound down upper lip, scarred from previous operations, meeting the lower at the angles only, and hindering any outward growth of the alveolar process. The lower lip protrudes beyond the apparent prognathus mandible to varying degrees. The central portion of the vermillion border can, under great effort, be controlled to meet the upper lip. It is usually loosely hung and has been singularly developed to take the active part in speech, the upper lip being more or less non-functioning. The teeth, when erupted, are forced into abnormal positions, become very irregular and many are lost early through decay or disease.

The first step in repair then centers itself in restoring the upper lip to as nearly a normal contour as possible. Four vital points must be considered: the size, the relation to the lower lip, restoration of the labial sulcus and the cupid's bow.

The size of the upper lip is determined by measuring the size of the lower. Allowance must be made for a certain amount of contracture and removal of scars. Several methods have been devised to increase the size of the lip. Upon careful analysis, we know that the original deformity occurs in the central portion of the lip and not at the angles. The repairs previously made have resulted in central scars. Therefore, the type of operation which utilizes the central portion of the lip has been chosen. This leaves the angles of the mouth unscarred and results in a more pleasing outline. The central portion may at the same time be lengthened which is also an advantage. In our hands, the Abbé operation, even though its disadvantages are well recognized, serves the best purposes. It is simple in design, restores full thickness

of the lip, including normal lining and covering, and brings a near normal relationship with the lower lip.

stumps are allowed to contract. Measurements are taken and a V-shaped flap is cut from the lower lip, leaving a small

A B

C

FIG. 1. For descriptive legend see opposite page.

The operation consists of the transfer of a triangular pedicled flap from the lower lip to the upper lip. An incision extending from the base of the columella to and through the vermillion border is made in the center of the upper lip; the incision is carried through the entire substance of the lip creating a central defect. The lateral pedicle at the vermillion border. The apex of the flap is turned and sutured to the apex of the triangular defect in the upper lip and all edges are carefully sutured in layers. The lower lip defect is closed in the same manner, and the two lips are sewed together with stay sutures. The patient is fed through a tube for a period

of fourteen days. At any time thereafter the flap may be excised from the pedicle, the vermillion borders of both lips re-

result. Unfortunately, mere closure of the cleft tissues leaves the soft palate pulled far forward and the oropharynx abnor-

D E

Fig. 1. A and B, characteristic type of deformity; note tightly bound down upper lip, the apparent disproportion in growth between maxillae and mandible, the loosely hung lower lip, and irregularity of facial contour; C, the triangular transplant of full thickness of lower lip to upper prior to separation (Abbe operation); D and E, improved facial contour obtained by lip plastic and placement of denture.

arranged and the edges sutured. The stay sutures are removed and the patient allowed soft foods until healing occurs. In a comparatively short time marked improvement may be noted in both appearance and speech.

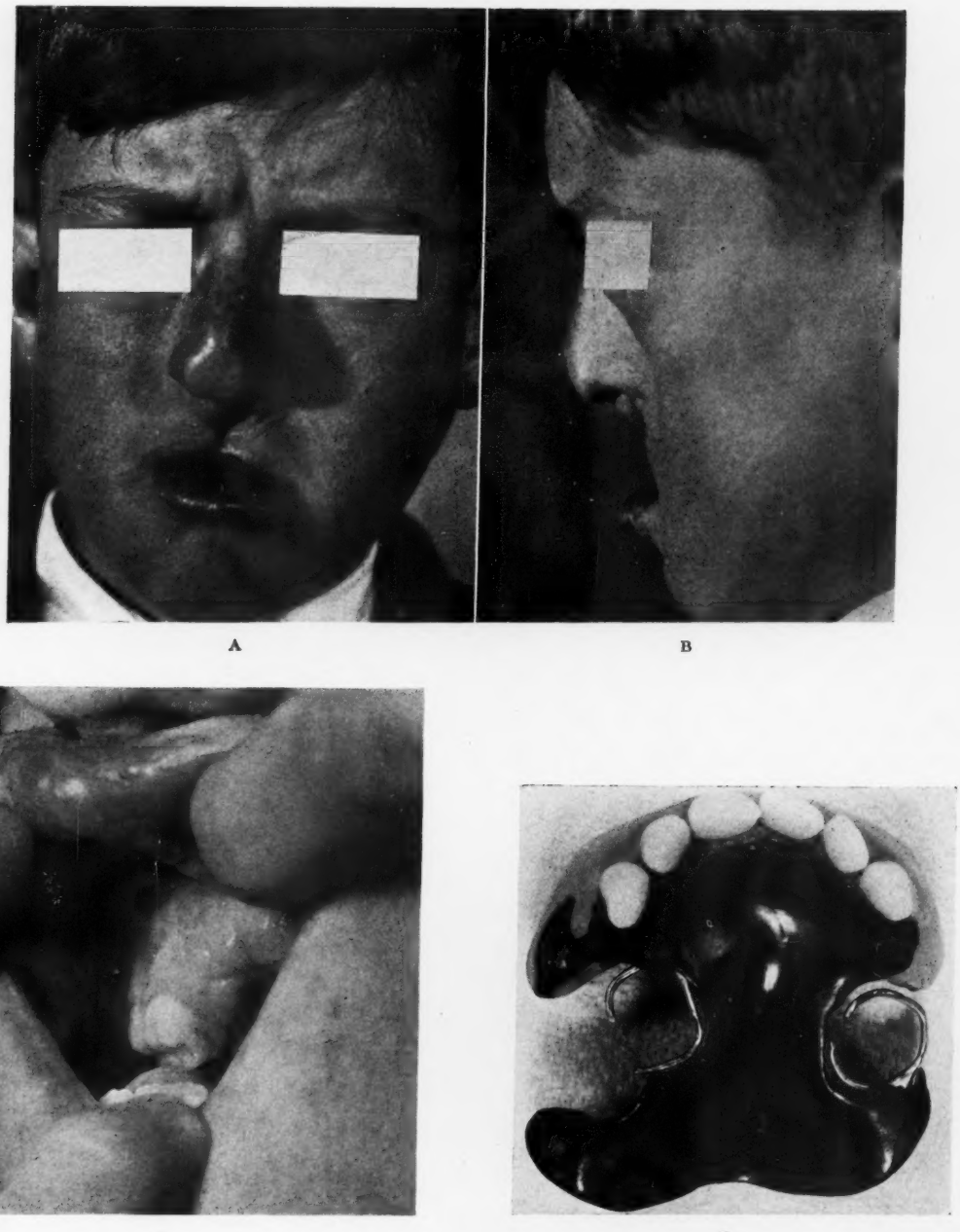
We now have a more nearly normal upper lip which meets the lower lip in the central portion as well as at the angles; and though it may be quite bound down to the alveolus in part, it is relatively equal in size and more mobile than before operation. The restoration of the labial sulcus and the creation of the cupid's bow is left until the palate is corrected.

The Palate. Depending upon the failure or successes from previous operations and the type of the original deformity, these cases may show any defect from a short, tense soft palate to a simple opening. In a large series of cases every type of secondary defect is encountered and good judgment is required if function is to be restored. There is a great tendency to consider a closed cleft in the palate as a good surgical

mally wide. The importance of obtaining velopharyngeal closure cannot be overemphasized. The sphincter-like action between the oropharynx, nasopharynx and the posterior part of the tongue cannot exist in the presence of a short tense velum. Since a functioning palate depends upon length and flexibility, special study should be given these cases to procure, in addition to facial contour, the added palatal corrections. Variations in methods of correction are numerous, but any plan which will close existing openings and lengthen the palate with the least amount of scarring is recommended. Where feasible, the Dorrance push-back operation may be used advantageously.

The Prosthesis. In the construction of any prosthetic appliance for the correction of deformities of the maxilla or mandible, either congenital or acquired, the complete understanding by the surgeon of the existing prosthetic problems lends to the success of the construction and fabrication of the complicated appliances necessary.

In the case of oral deformities the biologic aspects must be the first consideration by the prosthodontist if he is to be of any help to the surgeon. His knowledge and ingenuity in dental prostheses cannot be overbalanced or he would lose sight of the anatomy and physiology. The overemphasis of the mechanical side of dental prostheses all too often leads to the construction of appliances which would be comparable to those made in a machine shop with the biologic aspect totally ignored. We are confronted with this typical type picture: few remaining teeth, generally malposed or deformed and carious (in the majority of cases), and the whole presenting a badly impaired masticatory apparatus.

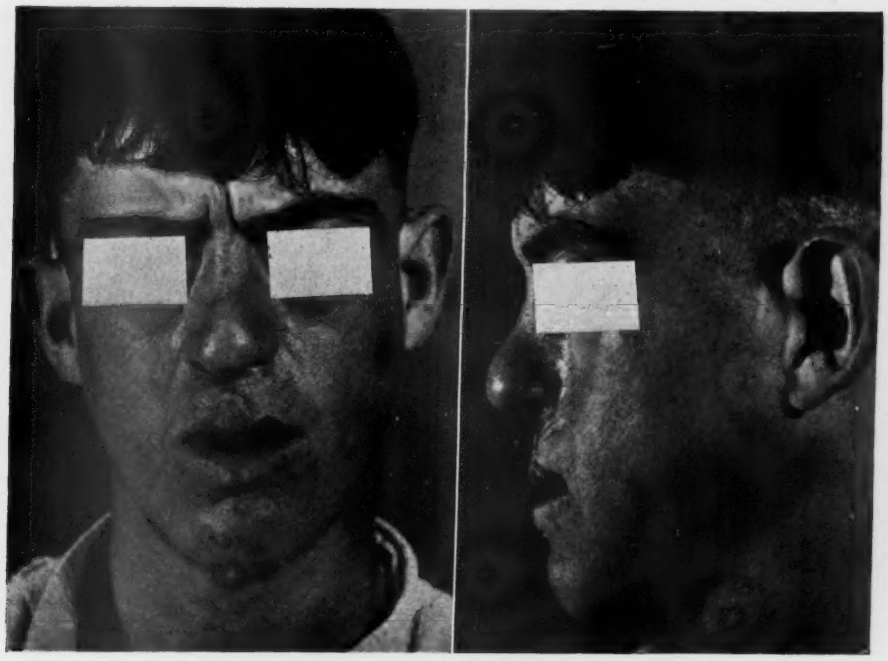


A B C D

FIG. 2. For descriptive legend see opposite page.

The prosthodontist must first realize the necessity of repairing the few remaining

teeth and have the mouth free from dental caries. These teeth then can be used as a guide for the prosthetic restoration. If possible, proper interdigitation of the remaining teeth should be established by the orthodontist so the teeth will have their proper occlusal antagonists. The absence of the premaxillae offers a most serious problem because the other teeth must be used as the non-resilient supports for the prosthetic appliance and its relation to the resilient supports. The problem is best handled by splinting the non-resilient supports together and having them act as a constant, combining the resilient with the non-resilient supports. With these factors under control it becomes possible to construct an appliance in a functioning unit. These appliances are built with the thought in mind of not subjecting them to more than one and one-half hours per day of masticating force or approximately one-half hour per meal. This would leave a twenty-two and one-half hour rest period for the supporting tissues under the appliance. The longevity of these cases is dependent largely upon certain factors of which the most important problems are the degree of health and tone of the investing tissues of the teeth *in situ*.



E F

FIG. 2. A and B, this patient has had the premaxillae excised, and an attempt made to close the lateral halves of the maxillae by crushing forceps—a surgical error. He was embarrassed and ridiculed by his schoolmates, because very maladjusted and self-conscious. C, large intra-oral skin graft placed to deepen labial and buccal sulci; D, denture with attachments to restore lost teeth and fill out irregularity of facial contours; E and F, result following the series of operations as outlined in the text. This patient now holds an important position and has become economically and socially independent. Compare with Fig. 2A and B.

The Labial Sulcus. In the majority of these cases, the upper lip, even when enlarged by the Abbé operation is still bound down to the external alveolar margin and is not flexible enough to allow full mobility. In order to obtain the proper external contour and the dental relationship, it is therefore necessary to deepen the labial (and sometimes the buccal) sulcus. With the denture in place, some estimate may be made of the amount of denture material needed to restore the contour and obtain a pleasing profile. The sulcus is deepened by incision of the mucosa beneath the lip,

using the normal buccal fold as the guide. The tissues are dissected from the bone and extended to a higher elevation than

modelling compound, heated to proper consistency, is added to the outer rim of the denture in sufficient amount to over-

A B

C D

FIG. 3. For descriptive legend see page 112.

will be eventually needed. This dissection creates a large pocket with raw areas on the sides of both the bone and the lip. When bleeding is controlled "Stent" or dental

fill the prepared raw pocket beneath the lip. The denture is now gradually forced to place with the lip fully extended by an assistant. The lip is then loosened and

allowed to droop over the denture while the surgeon moulds the overlying tissues and forces the compound well up into the pocket. A sharp impression, filling in the entire defect should be obtained, even though the compound may have to be reheated and replaced several times. When cooled, the denture is removed, the excess compound trimmed off, and by repeated trials a pleasing normal contour obtained.

E

F

G

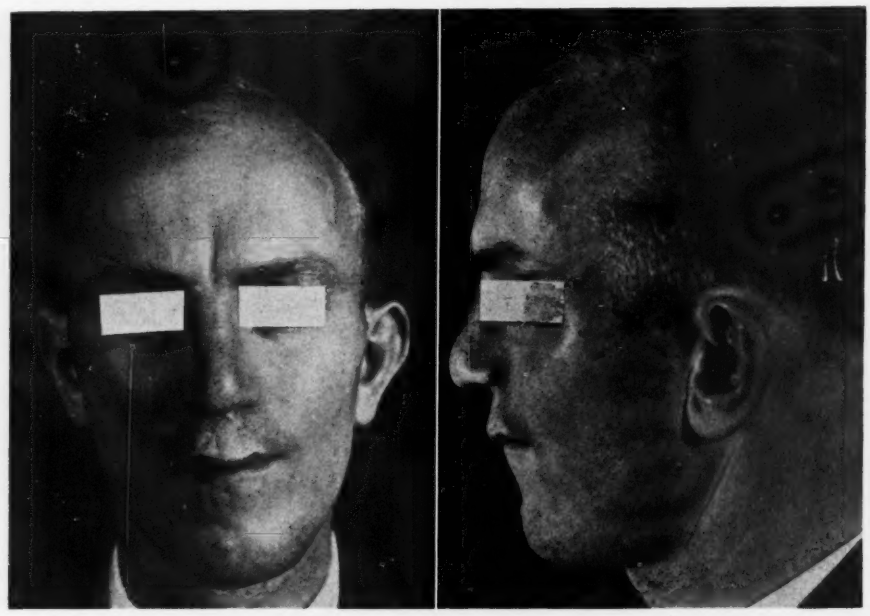
H

FIG. 3. For descriptive legend sss page 112.

The denture is now removed and set aside for the reception of the free skin graft.

Intra-oral skin grafts were first used by Esser during the first world war and named the Esser epithelial inlay. This method was improved by Gillies who used dental attachments with trays for the compound for retention of the graft. Skin makes an excellent substitute for mucosa, and if kept extended for a period of time does not contract in the mouth. The donor area should be selected with care so that the skin used is thin and free from hair. The graft is cut in the usual manner, using either a special knife or the Padgett

dermatome if desired. The graft is draped over the modelling compound on the denture, so that when the denture is placed, the prosthodontist for replacement of the compound rim. During this replacement the patient must wear some form of com-



I J

FIG. 3. A and B, the end result of a series of operations in infancy and childhood. Note the disproportion of maxillo-mandibular relationship, the inability to close the central portion of the lips, and the general irregularity in facial contour. C, immediate result following the Abbe operation with pedicle uncut; D, upper lip pulled upward and outward to show the deepened labial sulcus after extraction of malformed teeth and placement of intra-oral skin graft; E, dental prosthesis made to restore lost teeth and improve facial contour; F, the improvement in facial contour after rhinoplasty and placement of denture; G and H, comparable photographs showing changes in contour with lips separated; I and J, photographs—two years later—showing result of the series of operations listed in the text. Compare with Fig. 3A and B.

the raw surfaces of the graft and the raw surfaces of the pocket defect will be in contact. Excess graft may be excised, but there must be enough to cover all raw areas. The denture bearing the graft is fitted to place and the patient returned to bed. Instructions are given that the denture is not to be disturbed in any way for a period of ten to twelve days, liquids only being allowed as diet. At the end of this period, the denture is carefully removed, washed thoroughly, the excess graft trimmed away, and after cleansing the mouth, the denture is replaced. The graft must be kept in extension at all times for a period of several months or contracture and loss of space will result. The patient is instructed to wear the denture for two to four weeks before returning to pound prosthesis to retain the grafted pocket in full expansion in order to prevent contracture. The replacement should be done within a twenty-four hour period if possible.

The artistic effect of the restored contour will be in direct proportion to the artistry displayed in the denture and the external surgical procedures. When the denture is replaced, the patient is dismissed for a few weeks with instruction for exercises of cheek, lips and tongue to restore muscle tone and facial expression. At this stage there is usually noted a beginning change in the patient's reactions. He is more self-confident, takes better care of his personal appearance and even though somewhat awkward in the use of his new denture, takes a new interest in life.

The Nose. The majority of these cases present some form of nasal deformity, varying from a large hump with a depressed tip to simple flattened ala. Nearly all have one nostril lying more horizontally than the other, and in many the lateral alar cartilage projects downward. The nose, being the most prominent facial feature, requires special study in relation to the face as a whole. An accurate diagnosis of the malformation should first be made. Where it is necessary, face masks may be taken and models made so that the correction may be readily planned. It would be difficult to undertake a detailed account of the operations designed to correct each deformity in a paper of this type. The field of rhinoplasty has been well covered by various authors and references to them are available to all. The surgical corrections should be carried out with the end in view to obtain as nearly normal a facial contour as possible.

A B

Fig. 4. A and B, A shows patient after several operative procedures in early infancy. The irregularity of facial contour is increased by the prognathus mandible and the long humped nose; B shows resulting improvement from rhinoplasty, intra-oral skin graft and prosthesis.

Cupid's Bow. After all major deformities have been corrected and a pleasing contour has been obtained, it may be found that there are some slight irregularities in the vermillion border of the upper lip. These irregularities are most distressing to the patient. This presents a real problem to the female who uses lip stick which must be evenly applied. The formation of a Cupid's bow gives a much more pleasing outline and is not a difficult procedure. After the usual preparation, the Cupid's bow is outlined on the skin and mucosa with dye. Excision of the outline is made, the musoca is undercut and raised to its new position and sutured with fine plastic sutures. The esthetic improvement is well worth the effort.

The follow-up on these patients is an interesting study. During the series of operations, it is noted that with each improvement the psychology of the individual changes. He no longer attempts to hide his deformity, he carries his head erect and loses that "beaten" look which has marked him for so long. He usually looks eagerly forward to the next operation and

becomes even critical of minor difficulties. Parents come to tell of demands for better clothes and more frequent hair-cuts, of the time spent in massaging scars and general personal improvement. If in school, his interest improves and he gets better grades. When the operations are finished and he becomes accustomed to the denture and the lip loses its tenseness and becomes flexible, he willingly spends time in facial exercises to improve his muscle tone and expression.

As time passes, there is a blending of the scarred tissues and most of these patients are able to take their places as normal useful citizens.

SUMMARY

1. Definite psychological problems exist in most cases of cleft palate and hare-lip with poor operative results.

2. A plea is made to consider these cases as old healed injuries with deformity rather than as a congenital deformity for which much has been done.

3. Typical cases are described and certain characteristics are outlined.

4. A definite plan for repair is made in a series of operations made step by step, each dependent upon the other for reasons given.

5. A more nearly normal facial contour, together with palatal correction may be made in the majority of these cases by careful planning.

CONCLUSIONS

1. An improved mental state follows correction of facial deformities due to poor results from early cleft lip and palate repair.

2. A definite step-by-step plan for correction is necessary if more nearly normal facial contour is to be obtained.

3. Social and economic improvement follow in the wake of improved facial contour and speech.

4. Close co-operation between surgeon and dentist is a necessity in these cases.

5. The deepened labial sulcus by intra-oral skin grafting allows the prosthodontist to obtain a properly fitted artistic denture to restore the contour of the face.

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COMPRESSION FRACTURES OF THE LUMBAR VERTEBRA

WITHOUT CORD INVOLVEMENT

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IN this modern day with the increasing activity of industry, the widespread use of automobiles and airplanes, and the popular enthusiasm for vigorous outdoor sports, by male and female, the number of spinal fractures has increased.

In the early days many cases were overlooked due possibly to inadequate facilities in making a diagnosis. Today, we are confronted with these same patients who exhibit pain and perhaps deformities which are determined only by a routine roentgenological examination to determine the etiological factor of their complaint. It is rather difficult to estimate how many such patients have become hopeless cripples. Many could have lived out life expectancy in a normal manner if only they had obtained adequate treatment at the time of injury.

This paper is limited to compression fractures of the lumbar region without cord involvement. Therefore, no mention is made of cervical spine injuries.

The anatomical location was as follows: dorsolumbar junction, thirty two; second lumbar, twenty two; third lumbar, six; fourth and fifth lumbar, three; total cases sixty three.

The type and location of compression fractures of the lumbar vertebra depend largely upon the nature of the trauma and whether the violence is applied to the vertebral column by direct or indirect force.

FIRST AID

It is deplorable that many of the patients are treated by an overanxious individual who happens along, places the victim in an automobile and hurries him off to the hospital, without appreciating the damage which may be done by this form of transportation. Unfortunately, some of these patients have dislocations added to the fracture. Credit must be given the Red Cross and other agencies for decreasing this type of handling through lay education. In no type of fracture of the entire skeletal system is properly administered first aid treatment as important as in fracture of the spine. The important dictum "splint them where they lie" which applies to all fractures, is of considerable consequence in these cases. Proper first aid treatment may save a life and often prevents the development of a hopeless cripple.

The treatment of spinal fractures should begin at the scene of the accident. Every ambulance attendant, policeman and even the general public should be taught the underlying principle in handling cases of back injury.

Rolling the patient into the prone position on a blanket and with meticulous care raising and placing him on a litter is the important first aid step in the treatment. Then careful transportation to the hospital for roentgenological study and adequate treatment should be instituted, keeping the patient still in the prone position.

SIGNS AND SYMPTOMS

The signs and symptoms of a spinal injury may not be present immediately. We have perhaps all seen patients who have serious fractures, following an accident with minor complaints such as "pain or stiffness in the back," after which they have been able to get to their feet quickly and bend their body.

Certain signs and symptoms, if present, are pathognomonic of a fracture of the vertebrae though careful examination may be necessary to elicit them: (1) Localized pain over the site of fracture; (2) muscular rigidity of spinal muscles; (3) inability to stand erect; (4) weakness of back; (5)

retarded flexion at site of fracture, and (6) girdle pains may or may not be present.

DIAGNOSIS

With the roentgenologist primarily rests the burden of proof as to the presence and extent of fractures of the spine. Injuries with definite cord symptoms, while usually obvious clinically, still require a careful roentgenological examination just as do the patients presenting no definite clinical signs of fracture.

Since vertebral fractures are produced by hyperflexion when the limits of elasticity of the body is exceeded, a compression results. The spinal arch is composed of compact bone and as to the compressing force is exerted on the anterior portion of the body, the compression usually involves the anterior margin of the body. Compression or crushing fractures are most commonly encountered in the dorsolumbar region where flexion is least restricted while fractures from rotation and dislocations occur most frequently in the cervical region, the most flexible portion of the spine.

In routine radiography of spinal injuries anteroposterior and lateral views are always essential. Slight or moderately compressed bodies might easily be overlooked in the anteroposterior projection while a lateral film always demonstrates the reduced vertical height of the involved bodies quite strikingly. In this latter view the compressed bodies show a "wedging" or decreased height of the anterior portion of the body, the upper angle usually showing more compression than the lower angle. The resultant kyphos deformity depends upon the severity of the compression. Isolated fragments of the fractured body may be displaced forward slightly, limited by the anterior longitudinal ligament. Posterior displacement of isolated fragments into the spinal canal are also best demonstrated in the lateral projection.

Asymmetrical crushing of one or more bodies is not uncommon, resulting in a lateral deviation or scoliosis of the spine in addition to the kyphosis. These changes are best shown in the anteroposterior view in which stereoscopic projections are frequently valuable.

In addition to the two views mentioned, right and left 45 degree oblique films may be invaluable in bringing out accompanying fractures of the articular processes in which case there may be a dislocation also. Oblique projections also may present further information regarding fractures of the posterior spinous process, pedicle or lamina, which fractures, however, are seen to best advantage in a properly exposed lateral film. The *x*-ray examination must always be executed with great care, moving the patient gently and as little as possible to prevent further cord damage.

Fractures of two, three, or four vertebral bodies by the one compressing injury is not uncommon, the uppermost body usually showing the greatest degree of deformity and the lowermost body the least compression.

TREATMENT

As recently as the late twenties the customary treatment for a compression fracture of the vertebrae was accomplished by placing the patient in a recumbent position on a Bradford frame with or without traction to the head or feet for a four months' period. Then molded shells of plaster were made anteriorly and posteriorly so that the patient could be turned at frequent intervals in order to prevent pressure sores, if they were not already present. This latter procedure was carried out over a period of two additional months and was followed by a plaster jacket which was applied for the next three months. One could hardly estimate the deaths that must have occurred during this lengthy treatment due to pneumonia, septicemia complication, local infections, etc.

Fortunately, such men as Davis, Rogers, Boehler, Dunlop, Magnuson, and others have given us a clear understanding of the existing pathological state present in these cases. They have stressed the importance of a thorough understanding of the anat-

omy involved and have formulated the treatment, which in my opinion, is the outstanding to date.

The type of treatment applied in this group following the method so adequately described by Davis which consists of hyperextension with forcible manipulation of the fracture and application of a plaster jacket. Reduction was accomplished as soon as possible; in over 50 per cent it was done immediately following the roentgenological examination.

When shock existed, opiates were administered in sufficient doses to alleviate pain. The patient was kept quiet and warm and placed on a flat bed until shock subsided. Reduction was done as soon as the condition of the patient warranted.

In numerous cases of this series, I gave opiates before reduction. This is not in strict accordance with Davis' method of treatment, but the use of a narcotic enabled me to lessen pain and muscle spasm, thus facilitating reduction.

The day following reduction, a check-up roentgenological study was done in each case.

Results were as follows: satisfactory reduction after first manipulation, fifty-three; unsatisfactory reduction after first manipulation, nine; unsatisfactory reduction after second manipulation, one. Only in one case was re-manipulation necessary a third time.

All patients were kept recumbent for a period of three to fourteen days after which they were allowed to be ambulatory. The cast was worn for four months and was followed by an adequate brace. Only occasionally did the cast have to be removed, for loss of weight, pressure sores, etc. Then a new jacket was always applied.

This method of treatment has greatly reduced the time required to return these individuals to their former occupation and has materially decreased the hospital stay which is, of course, an important factor from the economical standpoint.

After the jacket was removed, postural exercises were given with a warning against heavy lifting in a stooped position.

PROGNOSIS

The majority of patients returned to their former occupations in five months. Those who had positions which did not require vigorous body activity and those who had less extensive fractures were returned sooner. Using methods similar to those described above, a patient who has had a compression fracture of the lumbar vertebra without cord involvement should get an excellent result. Most of the patients are able to carry on as well as before injury, unless their "damage suit" is still pending.

The treatment of sixty-three cases of compression fractures of the lumbar vertebra without cord involvement brings out the following points: (1) The danger of these cases being complicated through "Jack knifing by unskilled attendants is a formidable one." (2) "Place them prone and keep them prone" should be the watch word until the roentgenological study reveals the extent of the injury. (3) Reduction of fracture as soon as possible through manipulation while the spine is held in hyperextension and application of an adequate body cast have given us excellent results. (4) We have been impressed by the benefits of early ambulation and exercises.

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ALLERGIC PHENOMENA IN RELATION TO ABDOMINAL WOUND EVISCERATION

CASE REPORTS AND EXPERIMENTAL WORK*

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WOUND separation with evisceration is one of the most serious complications encountered by the abdominal surgeon in his innumerable and varied laparotomies. Such a complication seldom, if ever, is anticipated at the time of operation; and because of this unpreparedness it becomes one of the most embarrassing and difficult conditions to explain to the patient, as well as to his relatives when the calamity occurs. In my opinion, wound dehiscence should never happen except where certain unpreventable systemic disease processes are present at the time of surgery.

Fortunately, evisceration does not occur often. Depending statistically upon the number of cases cited, it varies from approximately 3/10 to 2 or 3 per cent. When the surgeon is confronted with this dreaded complication, he should automatically consider the situation a critical emergency as important as the ruptured abdominal viscus or perforated tubal pregnancy, and, with no thought of conservative waiting, his treatment should be immediate and definite.

During the past year a very puzzling case study with certain individual peculiarities caused me to perform experimental allergic tests on the patient with suggestive results. This case study will be presented in detail in this paper along with a five-year survey of cases from the surgical service of the Good Samaritan Hospital in Los Angeles.

Naturally, delayed healing with evisceration occurs frequently in the carcinomatous, cachectic, luetic or debilitated patient with some form of nutritional trophic disturbances, and defective suture material also may be a factor. Other indirect causes of evisceration should be considered under one heading, namely, any factor producing increased intra-abdominal pressure, such as excessive coughing, vomiting, or acute abdominal distention.

One should also consider the patient who takes an anesthetic poorly; in other words, that patient whose abdomen is never relaxed during the suturing process, which makes closure difficult.

The symptom picture of the patient who undergoes wound dehiscence is practically always that of a patient who is sick continuously from the date of surgery until the day of evisceration. These symptoms: fever, distention, nausea, fast pulse, etc., do not change to improvement as should be expected on the third postoperative day, but become progressively worse until there is noted some serum-staining of the dressing and often the sudden presence of wound gaping, revealing intestines on the abdominal surface.

Practically all wound separation occurs between the fifth and eleventh postoperative days. Although the operator may suspect that evisceration is going to occur, he hesitates to remove the clips until the routine sixth or seventh postoperative day, at which time the skin gapes open and the diagnosis is evident.

Treatment then should consist of immediate replacement of the viscera and strapping of the wound, and especially of the preferable method of resuturing the entire wound with non-absorbable material.

* All cases reported are from surgical statistics of the Good Samaritan Hospital of Los Angeles within a five-year period.

It will be seen from the facts presented in the case report submitted that one cannot very well leave allergic reactions out of the question of evisceration etiology. The reader of this paper should constantly remember that the express purpose of the writer is to narrow the field of wound separation so as to consider only that individual patient with average wound-healing powers. It always has been an accepted fact that generalized cachexia—whether it be from malignancy, long standing chronic disease, old age, avitaminosis or marked anemia—practically always play an important rôle in the production of wound separation when this occurs under such circumstances. In a careful survey of the literature one finds that the majority of wound eviscerations occurred following surgery for malignancy. The chief factor which stimulated my interest in this subject definitely was not evisceration *per se*, but rather that individual wound separation which followed lower abdominal surgery in an apparently normal, healthy individual; furthermore, an individual who had healed quickly following major surgery just six months previously.

In favor of the theory that allergy plays an important part in the production of evisceration, the following case report is presented:

CASE REPORT

Mrs. J. K., age fifty-three, white, American, was operated upon for toxic goiter; no chromic catgut was used and convalescence was normal.

The patient was readmitted to the Good Samaritan Hospital April 9, 1939, suffering from a large fibroid uterus. Total hysterectomy was done April 10th, spinal and gas anesthetic being used. There was no operative reaction, but on third postoperative day she continued to run a slight fever and experienced persistent nausea and vomiting. The wound appeared good, but the patient did not improve although no definite cause could be found. On April 16th, the fifth postoperative day, the entire wound showed complete evisceration. No catgut sutures were in evidence except one small strand of frayed and digested gut, and no knots were found. There was no trace of healing, but fascia and peritoneum were adhered. The wound was resutured with No. 5 and No. 3 Deknatel interrupted silk stitch. No drains were used.

This patient had a very stormy convalescence following secondary suture. She suffered all of the severe symptoms referable to acute gastric dilitation of the stomach as well as a very serious ileus. For three days following secondary repair she was treated with Wagensteen continuous suction, heat to the abdomen, intravenous fluids, enemas, and pitressin by hypodermic injection.

The wound, which had been sutured with interrupted No. 3 silk stitch closing peritoneum and fascia as one thick layer, healed completely and with no evidence of infection or weakness. In fact, the patient was able to go home one week after her radical evisceration. All stitches remained in for one week after she was home. The skin stitches were removed two weeks after surgery and it was at this time that allergic tests were performed on the patient.

These tests were made because of the shocking fact that five days after the operation none of the so-called "40-day" chromic gut remained in the fascial layer, not even the semblance of a knot in the extensive abdominal wound. We have here a striking example of a patient upon whom I had performed a thyroid operation just six months previously, but one in which no chromic catgut was used resulting in a quick convalescence, only to have the above stated wound rupture occur in the same patient for whom the only difference in technic was the use of chromic catgut in the second operation when none was used in the first. Thus, special tests on this chromic catgut were done.

From this case report it would appear that defective suture material could be ruled out. Had the chromic gut been defective in any part of its length, it would seem that at least a certain amount of suture material would have shown in the wound. In this case all gut was absorbed as if by magic. There was nothing in the reparative process of the wound that could

possibly be at fault, since six months previously I had performed a thyroidectomy on the same patient with rapid healing and a very satisfactory convalescence.

Based on a thorough analysis of the preceding case study along with experimental work to be discussed later, it is believed that certain patients are definitely allergic to certain types of absorbable catgut material, which fact would seem to play an important part in the mechanism of evisceration. This interesting case study caused me to make a radical and complete change in suture material in all types of surgery as well as to offer this paper.

In discussing this subject with other surgeons I find that those operators who use non-absorbable suture material throughout the entire abdominal wall have experienced no evidence of evisceration, either partial or complete.

Among writers discussing postoperative dehiscence, Hinton[1] has shown that chromic catgut was completely absorbed in his "clean cases" in which the bacterial cultures were negative. However, he believed that infection, when present, did play an important part in evisceration. It is my belief that in all "clean" operations neither infection nor hematoma formation plays any part in the mechanism of wound dehiscence.

In an account of fifty cases studied by Meleney and Howes,[2] they state that in all of their cases, whether occurring on the third or thirteenth day, the operator reported complete digestion of chromic gut, a fact which was true where there was absolutely no evidence of infection.

According to Kraissl[3] and co-workers, all of their animals experimentally sensitized with chromic gut enclosure, disrupted on the third to sixth postoperative day. All five of their patients who disrupted their abdominal wounds and who had histories of allergy, showed evidence of sensitivity to chromic gut.

It is the belief of Babcock[4] that allergic reactions are produced in the tissues which retard healing. He points out that there is much less reaction around silk than around catgut sutures.

Hinton, Kraissl, and Babcock all advance the theory that sensitivity to catgut may be responsible for premature absorption.

WOUND DEHISCENCE

Wound separation may be either partial or complete. A partial separation may be described as that condition in which the peritoneum and the fascia have begun to separate enough to allow the omentum or a knuckle of bowel to protrude a little into the opening, thus producing the partial evisceration. Such a condition, if obstruction does not supervene, can be compared with the postoperative ventral hernia in that the mechanisms are very similar. With each respiration, straining, coughing, vomiting, etc., there is a forward surge of bowel and omentum bombarding against the ventral postoperative herniation, tending to increase the fresh partial evisceration. In either case, there is a definite defect in both peritoneum and fascia with adhesions of omentum to muscle.

Wound separation may be partial as to its length as well as to its depth. Such wound separation may be partial in part of the wound and complete in another part; also, the separation may be complete throughout the entire extent of the wound, or there may be only a partial separation but extending throughout its full length.

Complete evisceration is that condition in which there is a separation of the abdominal surgical wound through its entire length, allowing omentum and bowel to eviscerate onto the abdomen.

Anatomically, the mechanism of wound separation may be classified as to the important layers of the abdominal wall that are involved in the separation: (1) The heavy anterior fascial sheath; (2) the thin weak posterior fascial sheath, and (3) the peritoneum and skin.

The mechanism of wound separation may be divided into upper abdominal

and lower abdominal. Anatomy and physiology play different rôles in their respective effects in the lower abdomen from those in the upper abdomen. In wound separation involving the upper abdomen, the omentum, provided there is no bowel obstruction, may commonly act as a bulwark of defense, and by its adhesion to the muscle prevent the partial separation from becoming complete. If one were to consider only physiological reasons, one would feel that wound separation in the upper abdomen more commonly results in postoperative ventral hernia, whereas in the lower abdomen evisceration results. It is believed that the etiology of ventral hernia depends largely upon the continuous bombardment of the adhered omentum against the anterior abdomen with each downward-forward surge of each respiration. Ventral hernia is common in the upper abdomen, and it would seem logical to assume that it is this plugging of the defect with adhered omentum which maintains the condition in the upper abdomen one of ventral hernia rather

Fig. 1.

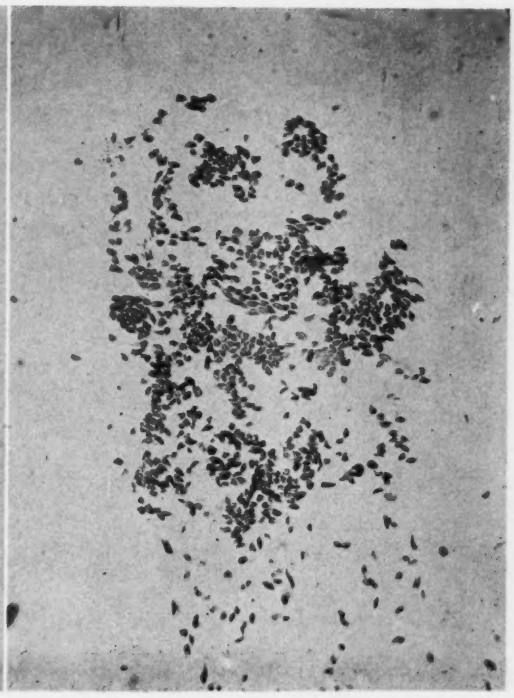

Fig. 2.

Fig. 1. A photograph cross section of No. 2 forty-day chromic catgut sectioned in paraffin block. This shows the normal diameter and contour of chromic catgut in cross section. The lower edge of this chromic gut was slightly frayed in the process of cutting the paraffin block. It was found extremely difficult to section different types of suture material. It is also noted that with this gut there is one solid unit of material present which, when it is fragmented or digested, would naturally completely weaken itself. The opposite is true when silk is used since there are innumerable individual strands as shown in Figure 2.

Fig. 2. This photograph is a cross section of No. 3 Deknatel silk sectioned in paraffin block. It shows the innumerable individual silk fibers present in a cross section of one strand of No. 3 Deknatel silk. Each individual fragment is a fiber in the silk. All of these fibers braided together produce an unusually strong suture material which is practically as strong as silver wire in its tensile strength since silver wire is weakened in the twisting of it. No. 4 Deknatel silk has the same type of cross section except there are more individual fibers. This stitch is unbreakable in a steady pull, and I believe it is stronger than either silver wire or kangaroo tendon. I am using this type of suture material now for bone repair work and find it extremely satisfactory in that this silk has absolutely no capillary attraction and gives no reaction of any kind when left buried in either bone or soft tissue. At the same time it offers a suture material of extremely high tensile strength and one which will hold the fragments of bone in adequate apposition in healing. It is better than either gut or wire.

than one of complete evisceration. In this survey of a private hospital it would seem to indicate that the omentum does

Fig. 3. This photograph shows very clearly the extreme fragmentation and digestion of one frayed, minute fragment of chromic catgut, found at one end of fascial plane in the eviscerated abdomen. This strand of material was extremely frayed and necrotic. There was no evidence anywhere of chromic catgut knots even though the catgut had been tied four different times at one place. The cross section of this frayed chromic gut shows the marked amount of fragmentation and separation into innumerably different fragments. This fragmented gut showed every evidence that it would be digested in that it was softened, macerated and necrotic. The fact that no stitches were left *in situ* in the fascia, and no chromic gut knots were found in the fascia, seemed striking evidence that we were dealing with some unknown allergic phenomenon or unknown chemical agent present in this particular body which seemed rapidly to eat up the chromic gut before healing could occur.

play a certain part since practically all cases of complete evisceration involved only the lower abdomen. If the wound separation is so severe as to produce complete evisceration in the upper abdomen, the prognosis becomes much more serious than the same condition in the lower abdomen.

The attending surgeon cannot afford to have such a drastic accident occur in his normally convalescing operative patient, as there is a definite ill effect psychologically not only upon the patient but upon the relatives and friends of the patient who know of such an occurrence. Unfortunately, the layman never understands why he had to have his "stomach" opened twice in one week. It is my opinion that evisceration constitutes a definite hazard in surgical practice.

It is believed that if the alert, attending physician diagnoses an early partial or even complete evisceration, provided it is discovered within the first twelve hours before there is any adhesion between the bowel and abdominal wall, he may cure the evisceration by simply replacing the visceral contents into the abdomen. Every sterile precaution of course should be used during the process, a hypodermic administered to the patient whose position in bed should remain unchanged, and the field of the wound cleansed with tincture of metaphen or a similar antiseptic.

When all the exposed contents are completely within the abdomen, the surgeon brings the edges of the wound out in apposition, holding it in place while a nurse paints the abdominal wall with tincture of benzoin well down on the sides of the patient. The wound is then strapped tightly together with two-inch adhesive tape, each strip being overlapped and criss-crossed obliquely over the abdomen.

I shall not readily forget my personal, rather dramatic experience of performing the preceding operation. We naturally were quite worried about a patient who did not respond well after surgery, in whom there was a persistent fever, slightly rapid pulse, and especially persistent nausea with emesis. It had always been a rule adopted by Dr. Charles T. Sturgeon, with whom I was working, to do frequent dressings on this type of case, looking for, first, evidence of wound infection; second, any postoperative wound serum, and third, any evidence of wound separation.

I saw this particular patient at nine in the evening and, because of her complaints regarding gas distention and nausea associated at this time with a sudden rise in temperature, I immediately ordered a dressing tray and examined the surgical wound. On lifting the sterile dressings, approximately two feet of small bowel were visible on top of the abdomen. This being a very fresh state of evisceration, I put on sterile gloves, cleansed the wound edges, placed the bowels in the abdomen, and closed the wound with two-inch tape, applying tincture of benzoin. Due to the fact that this patient had a known weakness in her lungs, my surgical judgment decided me to treat her conservatively by strapping rather than subjecting her to prolonged anesthesia and surgical resuture. Firm union of the outer abdominal wall resulted without secondary stitches. The patient improved rapidly without further complications, with the exception that she developed a late postoperative ventral hernia.

Probably such an unhappy situation has confronted the majority of surgeons. Since this experience about seven years ago, I have had three similar misfortunes, but on all of them secondary repair was performed with satisfactory results. Two of these patients were operated upon at a private hospital while a third patient was operated upon at the County Hospital, which I shall not present in this series. In this report only a private hospital survey is being made.

FIVE-YEAR HOSPITAL SURVEY OF CASES

Case I. Mrs. D. B., white, age fifty, was admitted to the hospital on October 15, 1934. Hysterectomy was performed on October 16th. The abdomen was repaired with plain No. 1 doubled for peritoneum, and 40-day No. 2 chromic in the fascia. Complete evisceration occurred on October 21st. This patient I treated by carefully releasing fresh adhesions of small bowel from the skin edges after which the intestines were placed within the abdomen and the wound strapped thoroughly with criss-cross formation. Normal convalescence followed and the patient was discharged from the hospital on November 22nd.

Case II. Mrs. E. B., white, age forty-seven, was admitted to the hospital December 1, 1936. Hysterectomy was performed December 2nd. Repair was done with plain No. 1 catgut doubled for peritoneum, and 40-day No. 2 for fascia. Complete evisceration occurred December 8th. The wound was resutured with through-and-through dermal sutures. Normal convalescence followed and the patient was discharged from the hospital on December 23rd.

Case III. Mrs. C. W., white, age sixty-four, was admitted to the hospital November 11, 1936. Hysterectomy was performed November 12th, and the abdomen was closed with plain No. 1 catgut for peritoneum and 40-day Number 2 chromic for fascia. Complete evisceration occurred on November 21st. The wound was resutured with through-and-through dermal stitch and normal convalescence followed. She was discharged from the hospital on December 12th.

Case IV. Mrs. J. M., white, age twenty-three, was admitted to the hospital December 14, 1936. Suspension of the uterus was performed on December 16th. Abdominal closure was done with plain No. 1 and chromic gut. Complete evisceration of the entire length of wound occurred on December 22nd. There was no evidence of infection and no evidence of healing. The wound was resutured with through-and-through dermal stitch. Normal convalescence followed and she was discharged from the hospital January 3, 1937.

Case V. Mr. R. S., white, age fifty-three, was admitted to the hospital January 26, 1935. Cholecystectomy was performed on January 29th and the abdomen closed with plain No. 1 gut and No. 2 chromic. Complete evisceration occurred February 11th. The wound was resutured with through-and-through dermal stitch. The patient died on February 17th.

Case VI. Mrs. J. A., white, age sixty-one, was admitted to the hospital March 15, 1937. Hysterectomy was done by myself March 16th and closure performed with plain No. 1 and chromic catgut. Complete evisceration occured on March 25th. The wound was resutured with figure-of-eight and interrupted chromic catgut and reinforced with through-and-through silkworm gut sutures. Normal convalescence followed but later a postopera-

tive hernia developed. The patient was discharged from the hospital April 12, 1937.

Case VII. Mrs. C. L., white, age thirty-five, was admitted to the hospital June 6, 1938. Hysterectomy was done on June 7. Closure was performed with plain No. 1 and chromic catgut. All catgut was found completely absorbed at the time of evisceration on June 16th. The wound was resutured with through-and-through dermal stitch. Normal convalescence followed and the patient was discharged on June 27th.

Case VIII. Mrs. L. P., white, age fifty-one, was admitted to the hospital October 14, 1938. Hysterectomy was done October 15th. Closure was made with plain No. 1 and chromic catgut. Partial evisceration occurred on October 25th. The wound was resutured with figure-of-eight and interrupted chromic gut, also silkworm gut. Normal convalescence followed and she was discharged November 15th.

Case IX. Mrs. G. W., white, age thirty, was admitted to the hospital June 17, 1938. She was operated upon June 18th for carcinoma of the rectum. Closure was made with plain No. 1 and chromic catgut. Complete evisceration occurred on June 23rd. The wound was resutured with through-and-through dermal stitch but the patient died on June 25th.

Case X. Miss E. B., white, age forty-two, was admitted to the hospital October 13, 1938, for multiocular ovarian cyst. Closure was performed with plain No. 1 catgut and interrupted chromic catgut in fascia. Complete evisceration of the entire wound occurred on October 26th. The abdomen was resutured with silver wire suture material. Normal convalescence followed and she was discharged November 17th.

Case XI. Mrs. J. K., white, age fifty-three, was admitted to the hospital April 9, 1939. Total hysterectomy was performed by myself on April 10th and closure made with plain No. 1 gut for peritoneum, 40-day catgut for fascia. Complete evisceration of the entire wound occurred on April 16th with no healing, no infection, nor evidence of 40-day chromic catgut left in wound. The wound was resutured with figure-of-eight and interrupted Deknatel No. 3 and No. 5 silk stitch. Normal convalescence followed and the patient was discharged from the hospital April 24th.

An additional very interesting case report was called to my attention by Dr. C. J. Berne when he found that I was working on this subject. The following case is given:

Case XII. Mr. D. G., age thirty-nine, white, was admitted to the Good Samaritan Hospital on February 18th. An abdominal operation was performed on February 19th. The abdomen was repaired with plain and chromic catgut, also three dermal retention sutures. The patient seemed to develop postoperative ileus, and on February 23rd was operated upon. Operative findings disclosed: entire and complete wound evisceration with loop of bowel up through the wound under the skin surface. Only a slight two-inch strand of plain catgut was found over the peritoneum at one edge. Not one minute particle of chromic gut, not even a knot, was found although it was only the fourth postoperative day.

The patient was resutured with braided silk No. 5 interrupted suture material. Following further treatment for ileus, the patient had an uneventful convalescence. During a personal conversation with Doctor Berne regarding this case, he was very emphatic in stating that the wound was entirely free of chromic suture and it seemed that some agent had completely absorbed the suture material. This case is almost identical in its characteristics with my Case XI.

Medical men accept the fact that individuals react differently to various drugs and foods and that they may be allergic to certain drugs, foods, etc. With these facts in mind, is it not reasonable to suggest that a specific individual may be sensitive or allergic to the chromic catgut used in suturing a wound? This surely would explain the unusual catalytic type of digestion and absorption of the chromic catgut.

Surely there is some unknown chemistry that goes on in this particular abdomen in the process of wound healing in that the catgut is so quickly destroyed, long before firm healing has occurred. However, it must be remembered that in the patient with normal nutritional background, this type of chemistry does not prevent satisfactory would healing following the use of secondary suture with non-absorbable material.

ALLERGIC MANIFESTATIONS

In retrospect, when the surgeon carefully reviews the immediate postoperative course of his patients with evisceration, he will usually observe that the patient was ailing continuously from the time of operation until the day of actual observed evisceration, which usually is the day that he removes the clips or skin stitches. That case does not seem to respond well following surgery. His chart indicates a continual low-grade temperature, nausea that develops into emesis, distention, gas pains, poor color, elevated pulse and, when ileus becomes more apparent, a coffee-ground foul emesis which frequently is projectile in character. Theoretically, it would appear that wound separation actually begins immediately after the patient leaves the operating room; that there is some chemical produced in the wound, possibly some allergenic substance, which acts immediately to poison the patient and at the same time to dissolve the catgut more rapidly than normally. It would seem that possibly this same poisonous allergenic substance acts to prevent average normal healing of the wound.

Catgut is derived from an animal (the sheep) whose serum is especially prone to cause allergic reactions in humans, thus the problem that possibly allergic reactions to the suture material may be due to its derivation. Possibly the reaction of the abdominal tissue to the catgut produces liquefaction which greatly delays the process of healing, even to the point of wound separation. There is decidedly much less tissue reaction around silk suture, cotton suture, or wire.

Although it is believed that the evisceration *per se* is an abrupt sudden rending apart of the abdominal wound, at the same time it is believed that in such a case there is a gradual chemical reaction, either allergic or otherwise, going on in this patient's wound immediately after the operation and progressively becoming worse until the evisceration occurs. It is believed that this progressive wound chemical action is a part of the reason for the patient's being "sick" continuously after the surgery up until the evisceration occurs. All of these patients are more or less distended after surgery and remain so until evisceration. The question is, why is it that one patient may be just as distended following a bowel obstruction and have the same suture material used but never suffer with evisceration? Every surgeon has experienced the case of a patient who has developed pneumonia following surgery, the patient who has had persistent coughing and gastric dilatation with persistent vomiting, but no evisceration. In view of these facts, one cannot consider that evisceration is solely due to an increased intra-abdominal tension. One cannot help but wonder whether in that particular case there is some unknown wound chemistry or allergy to the suture material used, or, more probably, actual defective suture material in combination with increased chemical action upon it to bring about the evisceration.

It is my contention that in all the cases of the normal convalescent, evisceration is not due to the operator's technic, nor to any one of numerous conditions causing the wound separation, but rather it is due to the suture material used in repair of the abdominal wall and, theoretically, possibly a chemical agent in that particular patient's body which acts quickly to dissolve the gut material. The patient has a definite idiosyncrasy to the chromicized gut and, as in all allergic conditions, attempts to throw off this poisonous material. Since the patient cannot throw it off by vomiting or similar methods, the next best thing is done —the so-called 40-day gut is digested in very quick fashion. Thus, within five days after operation not one minute strand or knot of chromic gut is left in the wound.

Along with this theoretical argument in favor of allergic wound evisceration, one must also consider briefly defective suture material. I believe, however, that such a condition is indeed rare fortunately, and

I say this because if the suture material were defective there would still undoubtedly be certain shreds or frayed-out portions of the suture left in the wound. At least the knots would still be present. The very fact that the wound is practically swept clean of all suture material is evidence against the suture being defective, and at the same time is evidence for the argument of catalytic wound digestion and absorption of catgut.

One cannot overlook the fact that there is a great variability in the rate of absorption of suture material in different individuals. Also it would seem that there is variability in the absorption time of different makes of catgut, and even there may be variations within the same grade of suture.

TREATMENT

There are two methods of treatment: (1) the conservative method to be used at the bedside, consisting of thorough strapping of the wound together, being very careful to use sterile technic throughout; (2) resuture of the wound with interrupted non-absorbable sutures, these sutures being through-and-through the adhered peritoneum and fascia and some through-and-through the entire abdominal wall. Both methods of treatment should be performed only after great care is used first to replace the intestines within the peritoneal cavity and to be sure there are no adhered intestines or omentum protruding out into the suture line. The surgical risk should be studied in each case and the conservative method practiced only when one is dealing with a critically ill patient or possibly the patient who is just beginning to eviscerate partially. Usually the secondary repair with non-absorbable suture is the method of choice and end results usually are satisfactory.

Naturally, in both methods it is very important to treat the patient's general condition symptomatically, as for example: (1) Treatment of acute dilitation and ileus by immediate and continuous suction-decompression; (2) the use of pitressin or other similar smooth muscle stimulants along with the usual enemas; (3) plenty of intravenous glucose and salt solution to combat shock and dehydration; (4) the routine postoperative use of carbon dioxide inhalation three times daily for thorough lung ventilation; (5) heat cradle to abdomen to aid in relaxation of the distention process; and (6) the patient should always be blood grouped for possible transfusion if necessary.

It is noteworthy here to remember that good results often are obtained in the patient with ileus by the early use of semi- and solid foods which in turn act to push along the stagnated column of gas.

Since my last case of evisceration two years ago (the one with allergic reaction) I have made a complete change in technic for all of my abdominal repair work. I now use chromic 0 catgut continuous suture for peritoneum and chromic 1 catgut interrupted suture for fascia. Also, I now use a reinforced interrupted type of No. 3 Deknatel silk stitch in the fascia. With this type of technic clips are used for approximation of the skin, but very little if any retention type of suture is used.

Since the change in technic of the closure of the abdomen, there have been no unsatisfactory results. All wounds have healed kindly and without serum collections or reactions of any kind. In spite of the occasional postoperative coughing experienced in certain extremely fat individuals and in the presence of debilitating conditions as diabetes and cancer, at no time was there any evidence of delay in wound repair.

Warshaw[5] points out that incomplete evisceration may be very well managed at the bedside, as was done in one of my early case reports. From my observations I am in agreement also with his comment that clean wounds rupture in the young as well as in the old.

McCauliff[6] reports no incidence of wound separation in which muscle retracting incision was used.

In the opinion of Ralph Colp,[7] the crux of the problem seems to rest in failure of regenerative powers of tissues to promote firm healing.

In a study of the absorption of catgut in humans, Wolff and Priestley[8] state that there is practically no difference in the rate of absorption between 20- and 40-day chromic catgut; also that small sizes of catgut last as long as or longer than larger sizes, that single strands last as long as double strands, and that pus wounds do not cause early absorption of catgut.

It would seem to me that in certain cases the serum collections in abdominal wounds are due to catgut absorptive reaction.

EXPERIMENTAL WORK

In view of the known controversy concerning allergy, particularly as related to this report, the following experimental work was performed:

The same type of 40-day chromic catgut No. 2, as well as plain catgut No. 1, were taken up into one-tenth normal sodium hydroxide solution by thoroughly grinding and macerating the catgut. This solution was used experimentally in Case XI in order to test the sensitivity of this patient to both chromic and plain catgut. Naturally one-tenth normal sodium hydroxide solution was used as control for all tests. The procedure of the experiment was to inject the catgut solution intradermally into the left arm of the patient and the control solution into the right.

In order to prove my theory of sensitivity more fully, further experimental work was done on ten patients who had had abdominal surgery in which both plain and chromic catgut were used in suturing. Control tests as well as injection of the catgut solution were done in each case. In order to check the experiment further, similar work was done on five individuals who had had no surgery. Each case was carefully observed and repeat tests were done when necessary.

Results. On all ten individuals who had surgery with catgut repair and also on all five who had no surgery, the intradermal hypodermic injection of extracts of the chromic and plain catgut produced no reaction. The control test likewise produced no reaction. The injection of the catgut material always produced an initial white bleb which showed slight inflammatory reaction but which was immediately absorbed without complicating phenomena.

The same experiment performed in Case XI produced different results. The solution of chromic catgut when injected intradermally produced an immediate blanching of the skin in a bleb formation which within five minutes turned a red color and then formed a large pinkish ring approximately four inches in diameter surrounding the site of injection. Neither the plain catgut injection nor the tenth normal sodium hydroxide control solution produced any noteworthy findings. But the chromic catgut injected into Mrs. J. K. produced pain, inflammation and itching in the arm which did not clear up for approximately one week.

To summarize, the findings in this particular case, with experimental evidence and especially the unusual condition of having performed a thyroidectomy on the same patient during the same year followed by rapid healing, would suggest the possibility of defective suture material in the abdominal surgery. The striking feature was that no chromic catgut was used in the thyroidectomy, whereas it was used in the abdominal operation, indicating that the chromic gut was the offending feature in this particular individual. It would be unwise to draw conclusions from just one case, but it supports my belief that there is a certain type of electrocolloidal chemistry present in each individual which may, theoretically, contain a special hyperactive catalytic agent which digests the chromic gut in that particularly sensitive individual. This agent acts to digest the offending catgut quickly which results in evisceration. I believe that this is truly a serious problem confront-

ing all surgeons who perform abdominal surgery.

CONCLUSIONS*

1. A case report of a patient allergic to chromic catgut is presented in this report, and, in view of the clinical as well as the experimental facts represented, it is believed that in certain cases allergy plays a part in wound evisceration.

2. The theory is suggested that defective or possibly "allergenic gut" (both of which are quickly digested and absorbed) and also possibly a special unknown chemistry in the wound healing, act together with conditions which cause increased intra-abdominal pressure, to produce the evisceration.

3. From conversations with other surgeons, both at Good Samaritan Hospital as well as other leading hospitals in Los Angeles, it is noted that all wounds of evisceration are resutured with some form of non-absorbable suture material and that usually healing occurs. It would seem that 40-day chromic catgut is actually only a name and that practically there is a great variation in the duration of such catgut.

4. Clean surgical wounds eviscerate in youth just as frequently as in old age.

5. The great majority of evisceration cases are found in patients who have undergone lower abdominal surgery.

6. Evisceration doubles the hospital time for the patient, creates a most embarrassing situation for both patient and physician, and in certain cases results in the death of the patient. It is believed that such a condition should never occur in the physically normal operative case.

7. Deknatel silk stitch has been used in the fascia as a reinforced interrupted type of stitch with marked satisfaction in all forms of abdominal surgery, and it is believed that this silk stitch gives the operator not only a safe wound closure but one without reaction of any kind.

8. Smaller sizes of chromic catgut are now used because it is believed they are stronger than the larger sizes, and result in a kinder healing process.

9. A majority of these patients were operated upon during Fall and Winter months, but there were *no* complicating colds or chronic coughs.

Since this paper was completed some time ago, Dr. A. J. Murieta has called my attention to his interesting case operated upon in October, 1942. The patient was a male upon whom Dr. Murieta did an abdominoperineal resection for adenocarcinoma of the rectum. The patient had a normal convalescence; but on the seventh postoperative day there developed a complete evisceration. The wound was clean, all gut stitches were completely absorbed and the wound had the appearance of being digested by some agent. Through-and-through non-absorbable stitches were used to reclose the abdomen. This resulted in satisfactory union and normal convalescence.

This patient had a long standing history of hay fever and the surgical pathological picture in evidence at the time of the evisceration was very suggestive of allergic phenomena related to the complete digestion of the chromic gut.

* From considerable observation of hospital records on this subject of evisceration in different hospitals, it would appear that statistics on this surgical condition are very inaccurate. This may be due to incomplete records in closing out charts with surgical complications listed or possibly due at times to an embarrassing condition which the surgeon dislikes to have recorded.

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CIRCUMCISION DRESSING

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WE present sketches of a dressing for circumcisions which we have employed and found simple and effective enough to deserve description. We do not claim originality but have been unable to discover who first devised the dressing, which was introduced to us by F. L. Pittinger, Pharmacist Mate Second Class, a member of our organization.

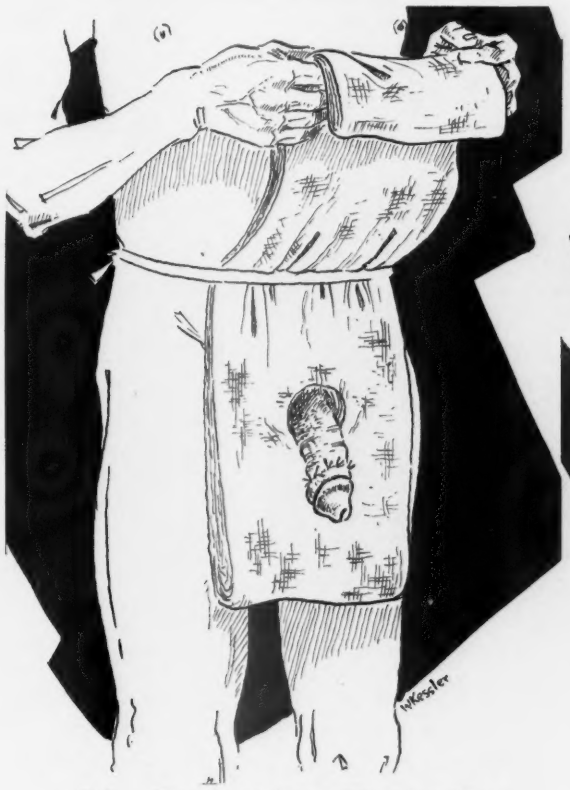

FIG. 1. Details of circumcision dressing.

FIG. 2. Dressing in place.

Standard thirty-six inch gauze folded in four thicknesses nine inches wide is folded lengthwise on itself to form a long gauze pad nine inches wide, thirty inches long and of twenty-four to thirty-six individual thicknesses. A hole, a couple of inches in diameter, is cut in the middle of the pad about nine inches from one end, through which the penis is slipped. The other, long, free end is brought up under a band of one-inch or two-inch gauze roller bandage tied about the patient's waist, and then allowed to drop down over the penis which now rests between the two parts of the nine-by-thirty inch gauze pad. Safety pins piercing both parts of the pad on each side of the penis hold it in place between the layers of gauze.

We have performed circumcisions on a number of Naval personnel on shipboard, most of them because of balanitis or constricting prepuce, using a technic under local anesthesia not differing greatly from those described by Bandler[1] and Pugh.[3] The dressing described above has been used successfully in thirty-eight of these cases. Ordinarily, we have wrapped the fresh

* The drawings in this article were made by Pharmacist's Mate W. W. Kessler, U.S.N.R.

wound with three-inch vaseline gauze strips, then applied the illustrated dry gauze dressing. The vaseline gauze is removed within a few hours or a day, and the dry dressing is used as long as it is needed. Healing occurs rapidly in most cases with no other treatment. Men are able to return promptly to work on deck or in the engine room wearing this dressing under their trousers. According to our observation and to the reports of the patients, the dressing is comfortable, remains in position well as long as it is pinned, and permits as much activity as the discomfort of the circumcision itself will allow.

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Pathological dislocations are the result of disease and are not treated as traumatic conditions. Congenital dislocations are developmental, and have no relation to traumatism.

From "Fractures and Dislocations for Practitioners," by Edwin O. Geckeler (Williams & Wilkins Company).

Case Reports

SCRAPE METHOD OF SKIN GRAFTING

CAPTAIN BENJAMIN F. GLASSER* AND CAPTAIN PADIE RICHLIN*
MEDICAL CORPS, ARMY OF THE UNITED STATES

PROMPTED by the present war emergency, we report what we believe to be an improved method in skin grafting. The method is based on the principle that the stratum germinativum is the essential factor in skin regeneration.

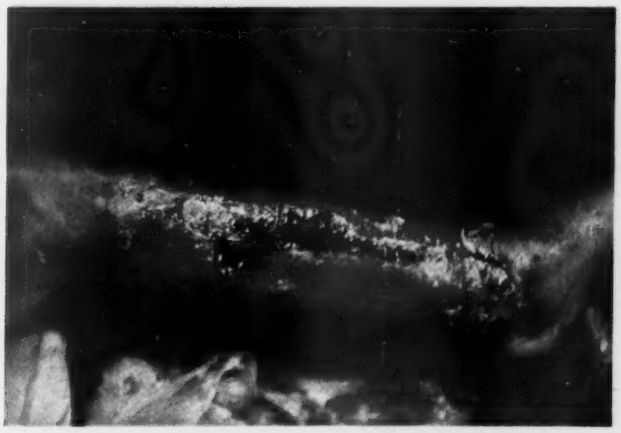

FIG. 1. Taken prior to first operation indicating exposed bone, muscle, tendon and through and through sinus.

CASE REPORT

The patient, W. C., a male, negro, fifty-seven years of age, was struck on the lower third of his right leg by a casting weighing twenty-five pounds, in November, 1941. An ulceration appeared but was neglected by the patient. The lesion remained localized for about ten weeks and then began to advance rapidly to involve most of the leg in the course of ten days. He was first seen by the authors on February 6, 1942. At that time he appeared acutely ill, was moderately drowsy and responded slowly to questioning.

His temperature was 103°F. The right leg presented extensive confluent ulcerations in the form of large irregular areas of denudation of the skin and subcutanea. About five-sixths of the skin surface was involved between the knee and the ankle. The edges of the ulcerations were serpiginous and sharply defined. The surfaces of the ulcerations were covered by many large irregular masses of blackish eschar. In addition there were several areas in the intervening skin which were beginning to break down and presented large bullae and diffuse redness and swelling. In one area of ulceration the tendons were exposed. There was a marked stench from the entire leg. The remaining skin was edematous, particularly that of the dorsum of the foot.

Laboratory findings: Kline test negative; white blood cells, 27,000 with polymorphonuclears, 89 per cent; blood sugar 108 mg.; urea nitrogen 19; aerobic culture of the ulcers showed Staphylococcus albus, pneumococcus, Bacillus coli and Bacillus tertius. The anaerobic culture was negative.

The destructive process was progressive for several weeks in spite of high caloric diet, rich vitamin intake, systemic and local therapy with sulfonamides, and other local treatment.

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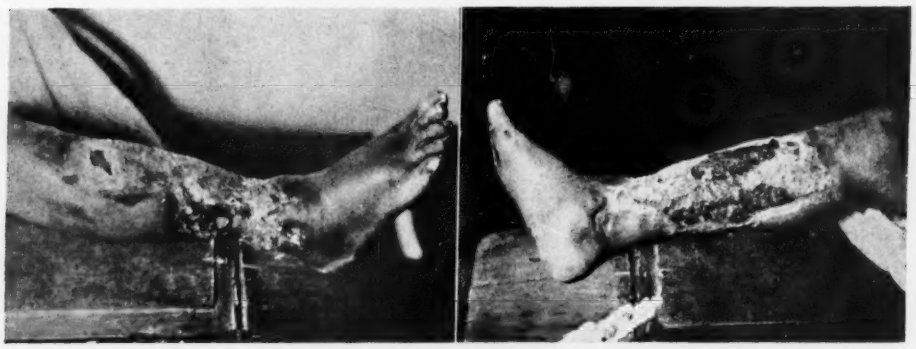
The ulcerations ultimately produced widespread exposure and partial necrosis of muscles and extensor tendons above the external sclerosis. The pulsations of the arteries were unobtainable in the right leg and were markedly diminished in the left leg.



A B

FIG. 2. A and B, taken April 14, 1942, three weeks after second skin graft. Note the first and second skin grafts cover areas around knee and ankle, respectively.

FIG. 3. Taken two weeks after third operation. Note multiple islands of skin regeneration over large area.

FIG. 4. Taken June 12, 1942, just prior to fourth operation.

malleolus. The crest and anterior surface of the tibia became exposed at several levels. A through-and-through sinus tract developed between the tendo achillis and the bones from above the internal malleolus to about two inches above the external malleolus. The temperature still fluctuated between 99 and 102°F.

It was our impression that the progressive nature of the process was probably attributable in part to an underlying peripheral arterio-

Eventually the infection and spread of the ulcerations began to yield to treatment, and his general condition started to improve. As an area of ulceration showed improvement an attempt was made to produce skin grafts. After a few preliminary experiments the method described below was evolved and was repeated in three different areas with a satisfactory growth of skin over the entire recipient

surface each time. The attempts to graft were made as soon as the infection was reasonably controlled over a substantial area. Because of to elapse in order to obtain the tissue in its most active stage of regeneration (later the waiting period was found unnecessary).

A B

Fig. 5. Taken about three months after patient returned to his regular work; shows entire leg completely healed except for small area on external surface, a few inches above ankle. Marked impairment of circulation probably accounts for the slow healing of this small area as there is a similar ulcer on the opposite leg. The rough appearance of the leg is due largely to the impressions made by an elastic circular bandage which was removed just prior to photography.

the continued suppuration and sloughing in several areas of the leg, the four operations had to be spread over several months.

Shortly after the last skin grafting the entire leg was covered with adequate skin except for a small area above the external malleolus. Marked impairment of circulation probably was responsible for the slow healing of this small area as there was a similar small ulcer on the opposite leg. This man returned to his former job on August 17, 1942, and has worked continuously since. He had a moderate limp at first which gradually disappeared completely.

PROCEDURE

The material employed for grafting was obtained in the form of bran-like flakes. After skin preparation for sterility the superficial layers of the donor area were pared away by gentle scraping with a sharp scalpel or razor blade until slight oozing appeared. In the initial experiments a period of five days was permitted The donor area was then scraped again in the same manner as previously but to a greater depth. This was best done under light general anesthesia with vinethene. The scrapings were then thoroughly mixed into a sterile solution of acacia to form a jelly. This mixture was then smeared with a tongue depressor over the recipient area. The latter had been prepared just prior to the graft by removal of redundant granulations with a scalpel to provide a smooth bed of healthy tissue. Following the application of the acacia mixture the entire area was dusted lightly with sulfathiazole powder. The scrapings were retained *in situ* by apposition of circular bandages impregnated with scarlet red. These were thickly overlaid with gauze compresses and an outer circular bandage was applied snugly. The extremity was then immobilized on a pillow splint with sandbags. The dressing was not changed until the fourth or fifth day.

The donor area was dusted heavily with sulfathiazole powder and a dry dressing was applied. The area was not redressed until it was presumed to be entirely healed.

The above method was employed four times, twice at the hospital and twice at the patient's home. The last two times the graft was made directly after paring the superficial layers of epidermis. The five-day waiting period was thereby dispensed with. This facilitated the procedure and the results appeared more satisfactory than in the original method.

In addition to rapid skin regeneration following this method, it was also noted that the above procedure produces remarkable control of infection, represented by rapid striking decrease in discharge and odor. It appeared that the greater the concentration of red blood cells that were smeared on an infected area the more noticeable was this effect. However, a special effort was made to keep the bleeding to a minimum.

The authors are unable to explain this unexpected phenomenon but it is their belief that the blood cells in combination with either serum and skin or alone manifest some inherent inhibitory factor to infection, yet unknown and unexplained. The presence of this factor in healthy tissue may explain why such tissue frequently offers a variable resistance to infection. The greater the concentration of this factor the greater the resistance to be expected.

COMMENTS

The advantages of this method may be listed as follows:

1. The procedure is simple. Only a few instruments are necessary, scalpel or razor blade, tongue depressor, medicine glass, and acacia (acacia helpful but not essential). The donor area is scraped twice, the deeper scrapings are mixed with sterile acacia and spread on the recipient area.
2. It can be performed speedily.
3. Prompt and satisfactory regeneration of the transplants is obtained.
4. It may be useful in treating infections.
5. The area from which the scrapings are obtained heals promptly without scarring.
6. The method may have further application in plastic surgery and in the healing of burns and war wounds when skin has to be matched with that of the opposite side of the body.
7. The possibility of employing this method immediately after skin injury (as in war wounds) is deserving of consideration.

VARICOSE VEINS OF THE ABDOMINAL WALL

REPORT OF A CASE DEMONSTRATED BY INFRA-RED PHOTOGRAPHY

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THE paucity of reports in the literature with regard to abdominal wall varices bespeaks the rarity of this condition. A sufficient number of cases has not been observed to permit conclusions concerning their etiology, and for the same reason there has been no standardization of treatment. However, there are many theories of origin of varicose veins which may apply to those of the abdominal wall as well as to those of the leg. It may be of value then to consider the theories of origin of varicose veins, to review the anatomy of the abdominal wall veins and to present an illustrative case.

In 1934, Froehlich[1] reported that abdominal wall varices were observed in about 1 per cent of the cases of varicose veins of the legs treated in the Vein and Ulcer Clinic of the Minneapolis General Hospital. This incidence has not been confirmed in the literature or in the present author's experience with approximately 500 cases of leg varices. In the one case to be reported at this time there was not a semblance of varicosity in any leg vein. Large, prominent normal veins are seen often in the abdominal wall, particularly in thin individuals and in conjunction with prominent veins elsewhere in the body. Enlarged or engorged abdominal veins are seen not uncommonly where there is portal obstruction or in iliac vein obstruction especially secondary to deep phlebothrombosis in the lower extremities. But these should not be designated as varicose veins in spite of the usual definition of a varicose vein as simply an "enlargement or dilatation of a vein." We shall refer here only to spontaneous, local venous enlargement characterized by tortuosity or sacculation.

THEORIES OF CAUSATION OF VARICOSE VEINS

Evidence offered by the present knowledge of the causation of varicose veins is not conclusive. The theory that varicose veins of the legs are contributed to by man's erect posture has many proponents. This is the popular explanation of Delbet who says that back pressure from the iliac veins causes the valves at the saphenofemoral junction to give way. Loss of valve function is the first step; dilatation of the vein is next. Almost exclusive occurrence of varicose veins in adult life is consistent with the fact that fewer valves are present in adult life than at birth. The same theory may hold in explaining simultaneous abdominal wall varices (if increased intravenous pressure is the important factor) since the superficial veins of the abdomen are tributaries of the great saphenous vein. However, in contradiction of the theory of increased intravenous pressure, McPheeters[2] has shown that varicose veins of the leg persist in spite of reduction of intravenous pressure by ligation of the great saphenous vein at the saphenofemoral junction. Furthermore, there may be severe unilateral varicose veins without the presence of varicosities in the other leg. If posture and increased intravenous pressure are etiological, the varicosities should appear bilaterally.

There is much in favor of another theory that formation of varicose veins is but one evidence of a general connective tissue weakness throughout the body. This is a progressive degenerative process which might apply in the case of persons of middle age or after. Another theory claims etiology or contribution by vitamin c deficiency; this would, according to the

rôle of vitamin c in the body, place this theory and the previous one on somewhat common ground.

endocrine, vitamin, constitutional (hereditary) or other factor. Aggravation by posture, increased intravenous pressure or

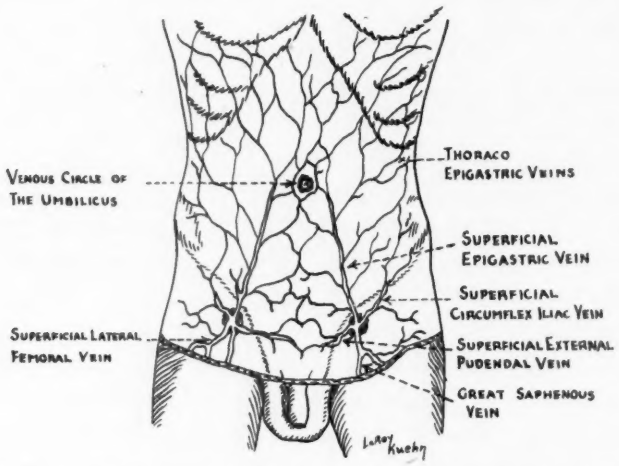

Fig. 1. The superficial veins of the abdomen and groin (modified from Toldt).

There is also the theory of an endocrine factor, based upon the observation that varicose veins are more common during pregnancy. This theory refers to primary dilatation in which the factor of pressure from a gravid uterus has been ruled out or in which venous enlargement occurs before the uterus has reached a size sufficient to produce pressure. It might carry more weight if it could explain the occurrence of varicose veins in men.

None of the above theories, however, explains the occurrence of isolated varices in remote portions of the body. For instance, the rare occurrence of a varicosity has been noted by the author over one supra-orbital ridge, also in a tributary of the cephalic vein over the biceps muscle of the upper arm, and in another case in the mucosa of the lip. In considering abdominal varices, Sarma[3] speaks of them in conjunction with varicosities of the legs and regards them as "leg" veins which run an upward course. McLaughlin[4] states that dilated veins in the lower part of the abdomen result from changes in the vessel walls similar to those occurring in varicose veins elsewhere. Spontaneous change in the vessel wall logically appears to be the initial step, whether or not there is an other state may then occur; but the primary tendency appears to be in the vein wall itself. When elasticity is lost, sacculation and tortuosity occur. Further support of this contention is gained from the observation that localized sacculations, aneurysmal in appearance, often occur in leg veins in which there is no incompetence of valves above the sacculation. Still further support should be derived from the occurrence of uncomplicated, isolated varicosities of the abdominal wall.

ANATOMY OF THE SUPERFICIAL VEINS OF THE ABDOMEN

The veins which may be involved in varicosities are the superficial epigastric, the superficial circumflex iliac, and the superficial external pudendal. (Fig. 1.)

The flow in these veins is downward into the femoral vein via the great saphenous vein. They may enter the saphenous vein individually or by a variable combination of trunks very close to the saphenofemoral junction. The superficial epigastric veins are the largest and most constant; they are almost always encountered in the medial portion of the oblique incision made for inguinal hernia repair. These veins possess extensive anastomoses. There is

anastomosis between the superficial circumflex iliac and the superficial lateral femoral, between the superficial epigastric and the deep epigastric vein which in turn anastomoses with the para-umbilical veins which empty into the portal system.

The para-umbilical veins lie in or just superficial to the peritoneum adjacent to the umbilicus and to the round ligament of the liver; they are sometimes known as the accessory portal veins of Sappey. Anastomosing with these is a more superficial anastomotic chain of small veins known as the "venous circle of the umbilicus" (Toldt). The enlargement of these veins in portal obstruction constitutes what is known as "caput medusae." The superficial epigastric veins also have connection with the thoraco-epigastric veins which are small veins arising in the region drained by the smaller tributaries of the superficial epigastrics (or may be directly continuous with the latter). The thoraco-epigastrics carry blood superiorward on each side of the trunk and eventually empty into the axillary veins. Anastomoses also exist between the superficial epigastrics and the internal mammary veins. It is easily seen then that portal drainage is toward the axilla and the internal mammary veins as well as toward the groin in portal obstruction; and drainage of the abdominal wall in femoral or iliac obstruction may be through the accessory portal system. The foregoing knowledge should be taken into consideration in the treatment of abdominal wall varices.

CASE REPORT

The patient, a twenty-three year old white female, was employed as a stenographer. She complained only of varicose veins of the abdomen which at times caused pain. These veins appeared about four years previously and began recently to enlarge, first on the left and then on the right side. There was some pain on the left side near the groin in the erect position, none in the supine position. She noticed that the veins were not filled in the supine position and that they filled and caused slight pain on straining. There had never been any inflammation, induration or evidence of thrombosis anywhere in the course of the enlarged veins. There had never been enlarged

Fig. 2. Infra-red photograph demonstrating varicose veins of lower abdomen.

veins of the lower extremities or symptoms of phlebothrombosis of the legs nor had there been dyspnea or swelling of the abdomen or of the ankles.

The only significant feature was the history of a shelf operation for congenital dislocation of the left hip, performed approximately six months prior to the appearance of the varices. There was an uneventful convalescence, and at no time in the postoperative period was there evidence of vascular obstruction in the groin or lower extremities. (Fig. 2.)

Both superficial epigastric veins were greatly enlarged and tortuous in the lower half of the abdomen. A large, tortuous collateral ran transversely from the right to the superior portion of the enlargement of the left superficial epigastric vein. The dilatation of both epigastrics ended abruptly at the groin. The veins emptied completely in the supine position and filled on sitting or standing. There was incomplete filling when both superficial epigastrics were compressed at the groin.

The liver edge was just palpable on deep inspiration; the spleen was not palpable. There was no ascites and no palpable masses. There was about 80 per cent of normal range of motion in the left hip and there was no pain or tenderness. There was a long scar on the lateral aspect of the left hip resulting from the shelf operation. No dilatation of any degree was found in any of the veins of the thighs or

legs. On pelvic examination the uterus and adnexae presented no palpable pathological change.

Under local anesthesia and through short incisions the veins were ligated and severed just superior to each inguinal ligament and at the junction of the left superficial epigastric with the horizontal collateral at which point there seemed to be a deep communication. The patient was allowed to be ambulatory and suffered no discomfort. Spontaneous thrombosis occurred throughout the varicosities and eliminated the need for sclerosing therapy. Multiple ligation was decided upon in preference to injection therapy alone as a safer and more permanent treatment which could be supplemented by injection therapy if necessary. An infra-red photograph (Fig. 2) was of help in demonstrating the morphology of the varices and in determining the points to be ligated. It is believed that the possibility of embolism through the portal system and through the femoral veins was minimized by preliminary ligation. Six months later the veins remained completely obliterated and asymptomatic.

SUMMARY

1. Some of the theories of formation of varicose veins have been presented.

2. The anatomy of the superficial veins of the abdomen has been discussed, especially with reference to anastomoses.

3. A case of uncomplicated varicose veins of the abdominal wall, without occurrence of varicosities elsewhere, has been reported.

4. Infra-red photography is a valuable adjunct in demonstrating the extent and connections of varicose veins. It may help in deciding the points at which ligations are to be done.

5. Preliminary ligation or ligation alone (as in the case presented) is the preferred treatment, because embolism seems less likely than when injection treatment alone is employed. Recurrence also is less likely.

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APPENDICITIS INCARCERATED IN A FEMORAL HERNIA

CASE REPORT

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THE Indicus Medicus has been reviewed for a period of ten years, from 1932 to 1943, both under femoral hernias and under appendix, and no reference to a case of the type herein reported could be found. We, therefore, submit this case as a first reported operation of an appendix incarcerated in a femoral hernia.

CASE REPORT

The patient, L. J. No. 39375, had a lump in the right groin for one year. About one year ago, with no known preceding etiology or trauma, the patient noticed a small lump in his right groin, which was neither painful nor tender. There had been no associated symptoms until ten days prior to admission, when the mass became suddenly larger and tender. There was a sharp pain on flexion of the body. The pain did not radiate and became constant twenty-four hours prior to admission. The bowels were regular and normal, and there never had been signs of obstruction or strangulation. There were no urinary complaints. Review of symptoms was entirely negative except for local condition. Two years previously the patient had an episode of acute cystitis which responded well to treatment.

Physical examination revealed the patient to be a well developed, well nourished, sixty-two year old white male, who did not appear ill. In the right groin, lateral to the pubic spine, there was an elongated, egg-sized, tense, and moderately tender mass, which was smooth and fixed and not reducible. The external inguinal ring was dilated but no impulse could be felt on coughing or straining. With the examining finger inside the external inguinal ring, the mass seemed to be entirely lateral to the canal wall. The left inguinal ring was also dilated, but no hernia was found. Blood pressure was 144/90. The abdomen was soft and not distended. No organs were palpable, and there was no tenderness. The extremities showed no edema or cyanosis.

Admission diagnosis was right femoral hernia, incarcerated.

Urinalysis was negative. The white blood count was 9,400 with 79 per cent polymorphonuclears. The case was considered operable, and with a preoperative diagnosis the same as the admission diagnosis, repair of the femoral hernia was attempted under avertin, gas-oxygen-ether anesthesia.

There was a femoral hernia about 4 cm. by 4 cm., oval in shape, tense, with the properitoneal fat over it hemorrhagic and friable. It was filled with straw-colored fluid and the vermiform appendix which was swollen, edematous, marked in a punctate fashion with dark hemorrhagic areas. The meso-appendix at the tip of the appendix was swollen to about 2 cm. in diameter and medial to this was thinned out. Even after removal of the swollen portion of the meso-appendix, the appendix could not be reduced. After opening the upper abdomen, all but about 1 cm. of the appendix was seen to be in the sac. The appendiceal artery entered the appendix through the mesentery about ½ cm. from the base. After reducing the appendix by traction above, and pushing from below through the lower wound, the hernial orifice would not admit the little finger. The cecum was attached well down by peritoneal reflections to the lateral and posterior abdominal wall.

A three-inch incision was made below and parallel to Poupart's ligament over the mass. The skin was walled off by towels, dissection was carried down to the sac, the sac was opened, the appendix was seen to be in the sac and was apparently acute; an unsuccessful attempt was made to reduce it. The meso-appendix within the sac was ligated and excised from the appendix, and still the appendix could not be reduced, nor could the cecum be pulled through the neck of the sac. A low McBurney

incision was then made, and the appendix was delivered by traction from above with a moderate amount of pressure from below. The sac neck was so tight that the muscularis of the appendix was divided about an inch from the base in its entire circumference, but the mucosa was not torn. The appendix was removed by ligation and division of the remaining meso-appendix to the base, clamp and cautery, with inversion of the stump through a linen purse-string. A figure-of-eight catgut on an atraumatic needle was placed over the inversion. The peritoneum was then closed by a continuous plain catgut suture. The transversalis, internal oblique, and external oblique were closed by interrupted No. 1 plain catgut sutures. The superficial fascia was closed by fine interrupted plain catgut, and interrupted silk was used for the skin. The hernial sac was then dissected down to its base, ligated, and removed. The stump of the sac was retracted well inside of the ring. One No. 2 chromic suture was used to close the opening of the ring which would not admit the tip of the little finger. The hemorrhagic properitoneal fat which had been dissected from the sac was removed, and the deep areas of the wound were closed by interrupted sutures of No. 0 plain catgut. Another layer of interrupted sutures was placed in the superficial fascia, and interrupted silk was used for the skin.

The specimen showed a femoral hernia sac, appendix, meso-appendix and fat. The appendix was 8 cm. long and 1 cm. wide; its serosa was rough, congested and denuded in the midline.

The appendix was much thickened by old connective tissue. The epithelium was actively secreting mucus. There was some lymphocytic exudate and some eosinophilic infiltration but no pus. The peritoneal coat contained greatly engorged blood vessels but showed a very minor inflammatory reaction. Various parts of the accompanying pieces of tissue were congested fat, or fat with some productive connective tissue as in adhesions, also congested but only mildly inflamed.

Diagnosis: Chronic appendicitis with recent peri-appendiceal congestion; congested omental or meso-appendix adhesions.

His postoperative course was uneventful; the sutures were removed on the eighth day and the patient was discharged as cured on the sixteenth day.

BENIGN PAPILLOMA OF THE AMPULLA OF VATER

CASE REPORT

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WHILE benign neoplasms of the ampulla of Vater are relatively rare, as compared to carcinoma with or without involvement of the pancreas, they probably should be considered more seriously when attempting to make a diagnosis of obstructive jaundice.

In 1936, Baggenstoss[1] reported twenty-five cases of polyp of the major papilla from the autopsies recorded at the Mayo Clinic. None were diagnosed before death and the reason for these patients coming to the clinic seemed to have had no relation to the papillomas found at autopsy, but from this report it may be assumed that papilloma of the ampulla is more common than we have believed. Baggenstoss also reported two cases of adenoma of the ampulla of Vater, described by Calzanara in 1895, one was removed by Stein, and another by Archibald.

Christopher[2] collected forty-one cases, with benign growths and added one of his own, in which an adenoma of the ampulla was found. Of the forty-five cases, sixteen were papillomas or polyps, fifteen adenomas, fourteen lipomas, two fibromas, two neuromas, two granulomas, and one a carcinoid.

Waters[3] stated that as late as 1930, only four of the reported benign tumors of the duodenum had been diagnosed by *x*-ray.

Horsley,[4] in 1941, reported on a case in which a one-stage resection of the duodenum was performed for tumor of the ampulla of Vater. Death occurred on the fourth postoperative day and the pathological report revealed an adenomatous structure, with no evidence of malignancy. This case, as does the case being reported, suggests the rational of opening the duodenum and either removing the growth, if it appears benign or if in doubt, obtaining a biopsy before a radical resection of the duodenum and head of the pancreas is done. At this time, the gallbladder or common duct should be anastomosed to either the stomach or jejunum. This later becomes the first stage of the radical operation, if it is necessary.

Cooper[5] states that, "no single operative procedure is suited to all varieties of tumor of the ampulla of Vater. If the tumor is a small papilloma, free of ulceration, and more or less pedunculated, without infiltration at its base, transduodenal resection with reimplantation of the ducts should be the ultimate procedure; while if the tumor is definitely malignant and infiltrates the duodenal wall, transduodenal resection obviously is not the procedure of choice and the radical operation should be attempted." This appears to me to be a sound approach to this very difficult problem.

CASE REPORT

A fifty-nine year old man was admitted to Emory University Hospital January 30, 1942, complaining of jaundice, anorexia and weakness. The jaundice had been present for a period of three months and had become much more intense during the week prior to admission. He had complained of pain only once and then, it was of short duration; stools had been clay-colored for two months; nausea and vomiting had first occurred three days before admission; he had complained of weakness since the onset of jaundice, and had lost approximately twenty pounds in weight.

Physical examination revealed an intensely jaundiced individual; the abdomen was soft, there was no tenderness and no mass was felt;

liver edge could be palpated about two and one-half finger breadths below the right costal margin; the gallbladder was not palpable; his temperature was normal.

mass could be felt in the duodenum or in the head of the pancreas and it was my impression, that we were probably dealing with a silent common duct stone. The patient's condition

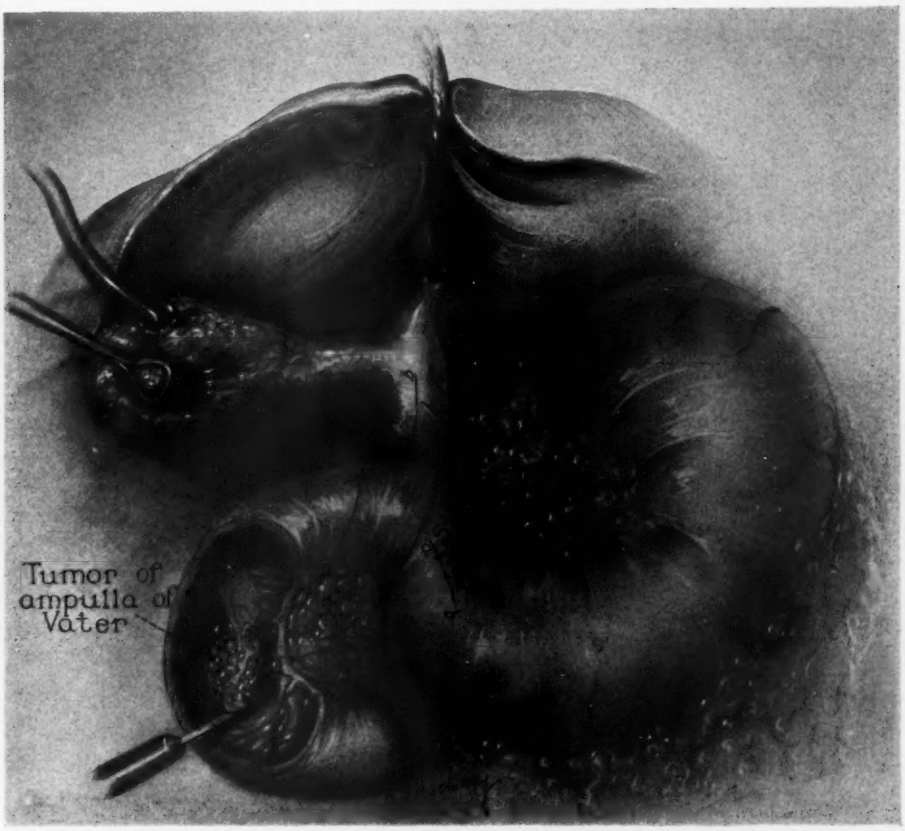

Fig. 1. Tumor of the ampulla of Vater.

Laboratory studies revealed the following: urine negative; red blood cells 4,200,222; hemoglobin 84 per cent; white blood cells 6,120 with normal differential; blood non-protein nitrogen, urea, sugar and creatinine normal; icteric index 30; direct Van den Bergh's was positive with 4.12 mg. bilirubin per 100 cc. serum; blood amylose 620; and the stools were persistently negative for bile. A preoperative diagnosis of obstructive jaundice, probably due to malignancy involving the head of the pancreas was made.

The patient was prepared for operation with intravenous infusions of glucose and saline, vitamin K, liver extract, along with transfusions; and on February 5, 1942, with intravenous sodium-pentothal, supplemented by nitrous oxide gas, for anesthesia, he was explored through a right subcostal incision. Instead of finding an enlarged thin walled gallbladder, the gallbladder was somewhat thickened, as was the common duct; no definite

was not very satisfactory, so a two-stage procedure was decided upon and a cholecystotomy was done, as the first stage. Following this operation, he drained bile freely and his jaundice rapidly cleared. With the bile being replaced through a Levine tube, his appetite improved; he gained weight, and his general condition became so satisfactory, that on March 13, 1942, he was again explored for a common duct stone through a right paramesial incision.

The common duct was opened and was found to be obstructed, but no stone could be felt. The second portion of the duodenum was then opened through its anterior wall, exposing what appeared to be a papilloma, the size of a walnut, growing in and completely obstructing the ampulla. While it was growing from a broad base, it did not appear to infiltrate extensively the duodenal wall or pancreas and was easily excised with the Bovie blade. The bleeding was controlled with a continuous locking stitch of

fine catgut and the incision in the anterior wall of the duodenum was closed transversely. An incision was then made in the anterior wall of the stomach to correspond in length to the incision in the common duct, and a side-to-side anastomosis, over a small rubber tube, was made between the common duct and the anterior wall of the stomach. This was easily accomplished without tension. The tube in the gallbladder was allowed to remain and the abdomen was closed. Bile was removed from the stomach through the Levine tube the following day, proving that the anastomosis was functioning. By the end of the third day, there was no bile draining from the gallbladder. The tube was then removed and the sinus promptly closed. The patient's convalescence was uneventful. He continued to gain weight; bile was present in his stools; there was no evidence of recurrence of jaundice and he was dismissed from the hospital, ambulatory, March 30, 1942.

It has been fourteen months since patient was dismissed from the hospital and he has remained entirely well. His normal weight has been maintained, there has been no recurrence of jaundice and he has shown no symptoms that would suggest regurgitation of the gastric contents into the biliary ducts.*

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* At the time this manuscript was presented, the patient appeared to be in normal good health but, a short time ago, he began to lose weight and examination showed what was believed to be a metastatic lesion, involving his lungs, from which he recently died. An autopsy could not be obtained and we are unable to state the exact cause of death. He did not develop jaundice and we have no good reason to believe that the malignancy that caused his death originated from the growth in the ampulla. I might add that these slides have since been reviewed and we could find no evidence of malignancy.

UNION OF PATHOLOGIC FRACTURE OF FEMUR FOLLOWING CASTRATIONS FOR CARCINOMA OF THE PROSTATE*

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THE experimental and clinical work of Huggins and his co-workers[1] and of numerous other investigators have firmly established the value of castration in the treatment of carcinoma of the prostate gland. The improvement resulting from this type of treatment has not been confined to the primary lesion in the prostate, but has been evident in metastatic lesions. Although the medical literature describes numerous instances of disappearance of bony metastases, there is no reference to healing of a pathologic fracture.

In the present case, a pathologic fracture of the femur showed no evidence of union until bilateral orchidectomy was done fourteen weeks after the fracture occurred. Of additional interest is the accompanying disappearance of the symptoms of obstruction to urination, a reduction in the amount of residual urine, and a regression in the size of the prostate gland as palpated by rectum.

CASE REPORT

This seventy-six year old man was admitted to the hospital on March 27, 1941. One hour previously, after suddenly turning around from a sitting position on a chair, he felt a severe pain in the left thigh. On attempting to arise, he experienced buckling of the injured thigh and was unable to support himself.

The medical history revealed no past illnesses nor complaints of significance except for increasing difficulty of urination, nocturia six to eight times, and dribbling. There had been no total retention of urine.

Blood pressure was 162/94; temperature: 98.6°F., pulse, 76; respirations, 22; moderate obesity. The definite abnormal findings were a small umbilical hernia, outward rotation and hypermobility of the left thigh, indicative of fracture of the left femur; arthritic deformity of fingers of both hands; moderate enlargement of the prostate gland as palpated by rectum, with the fixation and hardness of prostatic carcinoma.

The urine was straw color with an acid reaction; specific gravity 1011; albumin: 1 plus; sugar; negative. Microscopically, a few pus cells and innumerable red cells were found. Hemoglobin was 86 per cent; red blood cells 4,490,000; white blood cells 9,300; differential: 69 per cent polymorphonuclears, 31 per cent lymphocytes; blood urea nitrogen 25.3 mg.; creatinine: 3.6 mg.; blood Wassermann, negative.

A portable roentgenogram of the left hip on the day of admission was reported as follows: "There is a fracture involving the upper end of the left femur just below the trochanteric region. The fragments are in fairly good position. There is some rarefaction involving the shaft of the bone at the fracture site, the appearance being quite suggestive that the fracture is pathologic in nature and probably due to metastatic involvement of the bone."

The fracture was treated conservatively with light traction. Another roentgenogram (Fig. 1), May 23, 1941, (almost two months after the injury) was reported as follows: "There is rather extensive decalcification apparent about the lateral side of the innominate bone including the pubic rami, the acetabulum and upper femur. There is a deformity just below the lesser trochanter which is probably a pathologic fracture with formation of considerable new bone on either side."

About one month after the patient's hospital admission, the voided urine became grossly

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bloody, necessitating frequent bladder lavage for the removal of clots. A residual urine of 260 cc. was obtained by catheter. The urologic consultant at that time described the prostate as "large, hard, encroaching on the urethra, and probably carcinomatous" as palpated by rectum.

Fig. 1. Roentgenogram of left hip taken two months after the accident, showing the pathologic fracture with no evidence of union.

Almost four months after hospitalization, I examined the patient and decided on the basis of rectal palpation, that there was unquestionably a prostatic carcinoma. Bilateral orchidectomy was suggested as a means of improving urinary symptoms. Although transurethral resection of the bladder neck obstruction was considered, it was not done. The patient's relatives objected to further surgery because of his debility.

On July 14, 1941, (three and one-half months after the fracture occurred) bilateral orchidectomy was done under spinal anesthesia through incisions in the lower inguinal region. At the conclusion of the operation, a catheter was tied in the urethra. This was considered necessary because the urine was grossly purulent, and could well have contaminated the wounds. Convalescence was uneventful, and the patient was discharged from the hospital twenty-four days following the operation.

No accurate account of his condition was obtained for several months after hospital discharge because he never sought medical care. Because of improvement he considered further care unnecessary.

Only after a determined search was he found and brought to the hospital for a general examination. Union of the fracture had progressed sufficiently to permit walking with the aid of crutches. He did not complain of bladder dysfunction. One ounce of residual urine was obtained by catheter immediately after he had voided. Palpation of the prostate by rectum revealed a regression by volume to a small fraction of its previous size. The hardness of malignancy remained in an atrophic lobe to the left of the median sulcus but the remainder of the gland was of the consistency of normal prostate, and hardly protruded into the rectum.

Fig. 2. Roentgenogram of left hip fifteen days after bilateral orchidectomy. Described by roentgenologist as showing "considerable decalcification of the head, neck, trochanters and upper end of the shaft."

Additional roentgenograms of April 13, 1942 (Fig. 3), were reported as follows by the radiologist: "Comparison of the film with the previous examination of July 29, 1941, demonstrates that the fragments of the femur have firmly united in good position and with a moderate amount of callus formation. There is no evidence of any metastatic process involving either the lumbar spine or the bones of the pelvis."

No further examination was done until the patient was admitted to the hospital on Jan-

uary 29, 1943. Five days before, he had complained of a sudden severe pain in the left occipital region. He rapidly became very weak

Fig. 3. Roentgenogram of both hips nine months after castration. Solid bony union of fracture of left hip.

and dyspneic. There was no evidence of impaired function of his extremities. He remained mentally clear for two days, but then fell into a progressively deeper stupor. Death occurred shortly after admission. Only a cursory examination was possible. No new findings were disclosed. Rectal examination revealed further reduction in the size of the prostate gland. By questioning the relatives, it was determined that the patient had been in good health following the last examination. He had been able to walk with the use of a cane. Urination was unimpeded. He had shown a moderate weight gain and had increased vitality. Permission for an autopsy was not granted.

SUMMARY

A seventy-six year old male sustained a pathologic fracture of the femur. Physical examination revealed a carcinoma of the prostate gland. There was no roentgenologic evidence of union of the fracture after three months of traction. Bilateral orchidectomy was done but no attempt was made to remove the malignancy of the prostate. Subsequent roentgenograms showed solid union of the fracture eleven months after the orchidectomy. There was a concomitant disappearance of obstruction to urination and a great reduction in the size of the prostate as palpated by rectum. Death occurred twenty months after the orchidectomy, probably of a cerebral vascular accident.

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BILATERAL SIMULTANEOUS TUBAL PREGNANCY*

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IN searching through the literature we found that bilateral simultaneous tubal pregnancy is of rare occurrence. We feel justified, therefore, in reporting an additional authentic case.

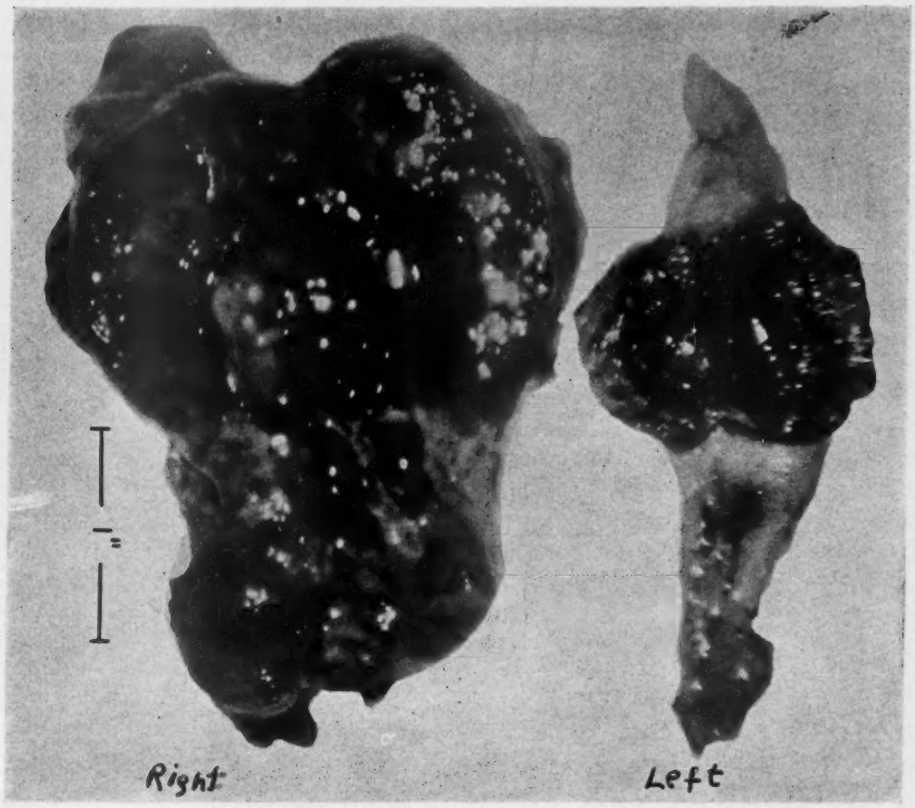

FIG. 1. Bilateral simultaneous tubal pregnancy.

CASE REPORT

M. K., a colored, female, married, age thirty, was admitted to the hospital on November 17, 1941. She was married five years, had no children, miscarriages or abortions. Menstruation began at age of fourteen, was of the regular twenty-eight-day type, lasting four days with occasional pain. She gave a history of a period on October 17, 1941, lasting one day instead of the usual four days.

On November 16th, she began to stain and had bearing down pain in both lower quadrants and a feeling of fullness in the pelvis. She also complained of dysuria. The staining increased in amount and was dark in color. She felt nauseated but did not vomit. Then pain began. Physical examination revealed a fairly well developed and well nourished, colored female. The abdomen was somewhat distended and tense and rather tender to palpation. A round, indefinite mass was palpable in the lower right quadrant. There was marked rigidity in both sides. Pelvic examination revealed a good pelvic floor and dark bloody discharge. The uterus was somewhat fixed and slightly enlarged. There was a fixed and tender mass the size of an orange in the right adnexal region. A smaller palpable mass was felt in the left side.

* From the Department of Gynecology, Unity Hospital, Brooklyn, New York.

A tentative diagnosis of bilateral chronic salpingitis and possible ectopic pregnancy was made.

Laboratory findings were: Leucocytes—13,200; red blood cells 4,100,000; hemoglobin—80 per cent; temperature—101°F.; pulse—82; respiration—26; urine was normal; sedimentation rate was 18 mm. in twenty-seven minutes.

We decided upon a conservative course and careful observation for several days. The patient's condition did not improve under conservative treatment; pain increased in intensity and staining did not stop, and it was deemed advisable to perform a laparotomy.

On November 25, 1941, a laparotomy was performed under spinal anesthesia. The peritoneal cavity contained no fluid or blood. An orange-sized mass was found in the right adnexal region matter together, right tube, ovary and omentum. In the left adnexal region the tube was swollen and contained a bluish, walnut-sized mass in the midportion of the tube. The left ovary contained a corpus luteum. Operation consisted of a right salpingo-oopherectomy and left salpingectomy.

The postoperative course was uneventful. The patient was discharged on the twelfth day in good condition.

Macroscopically, the right tube was irregular in outline; the center was elevated. It contained a hemorrhagic mass suggesting placental tissue. There was a fetus 2 cm. with cord. The left tube was 10 by 3 cm., irregular in outline and contained in the center midportion a bluish cystic mass 4 by 5 cm., and a small pinkish grey structure was seen adherent to the mucosal surface of the tube. This grossly suggested placental tissue.

Microscopic examination revealed that in the lumen of the tubes there was blood and chorionic villi and decidual cells. The chorionic villi were attached to the walls and free in the blood clot of the lumen. The villi were in a dissimilar developmental stage in both tubes. Through the wall were areas of hemorrhage; the blood vessels were dilated and congested. Extensive hemorrhage likewise had occurred into the interstitial tissue. In places the normal mucosa had disappeared and there was loose pseudodecidual reaction which had replaced the underlying stroma. Throughout the ovary there was marked fibrosis and cysts that were lined by several layers of epithelial cells resting on a basement membrane of fibrous connected tissue and round cells.

COMMENT

The variation in size of tubes and developmental dissimilarity of the chorionic villi strongly suggests a superfetation.

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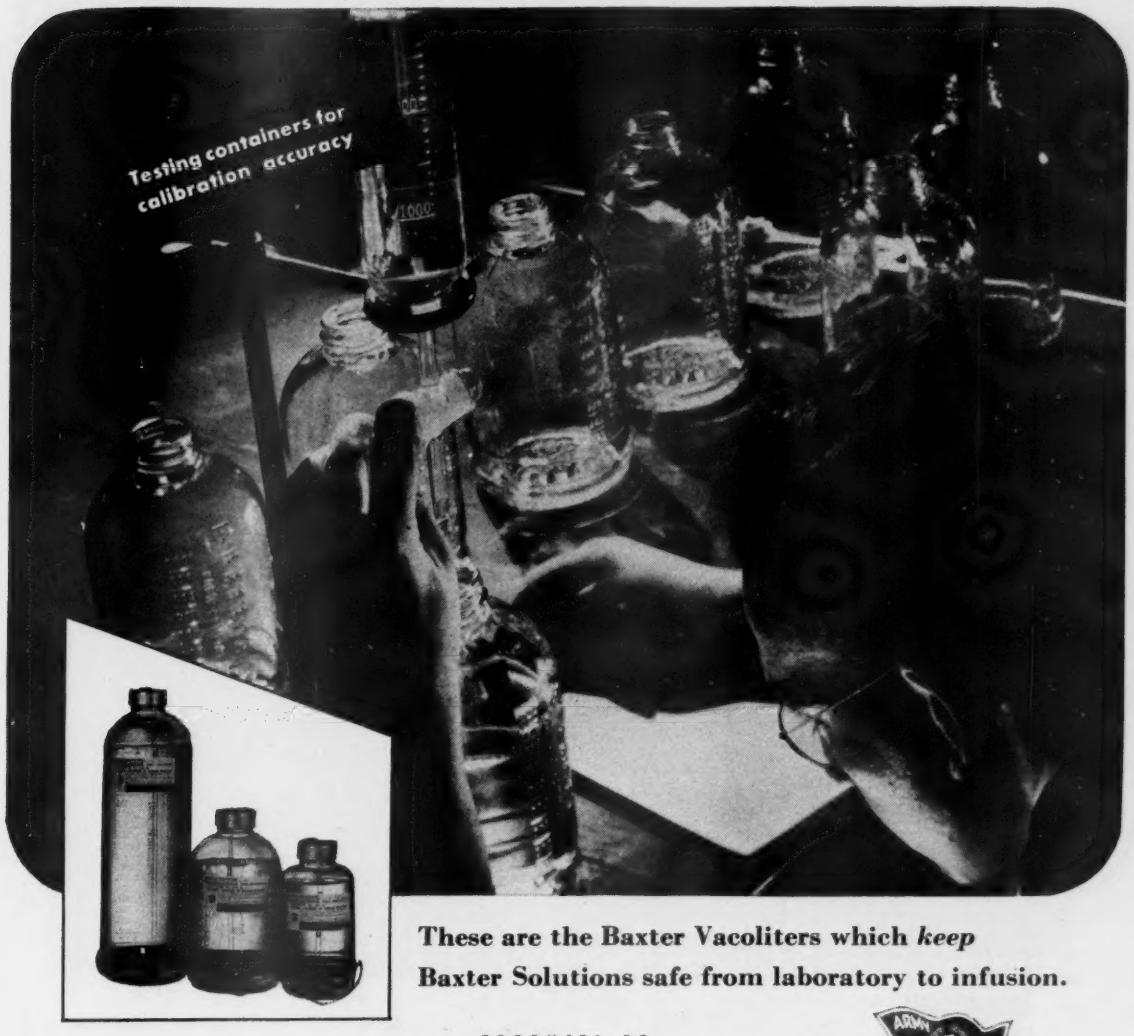

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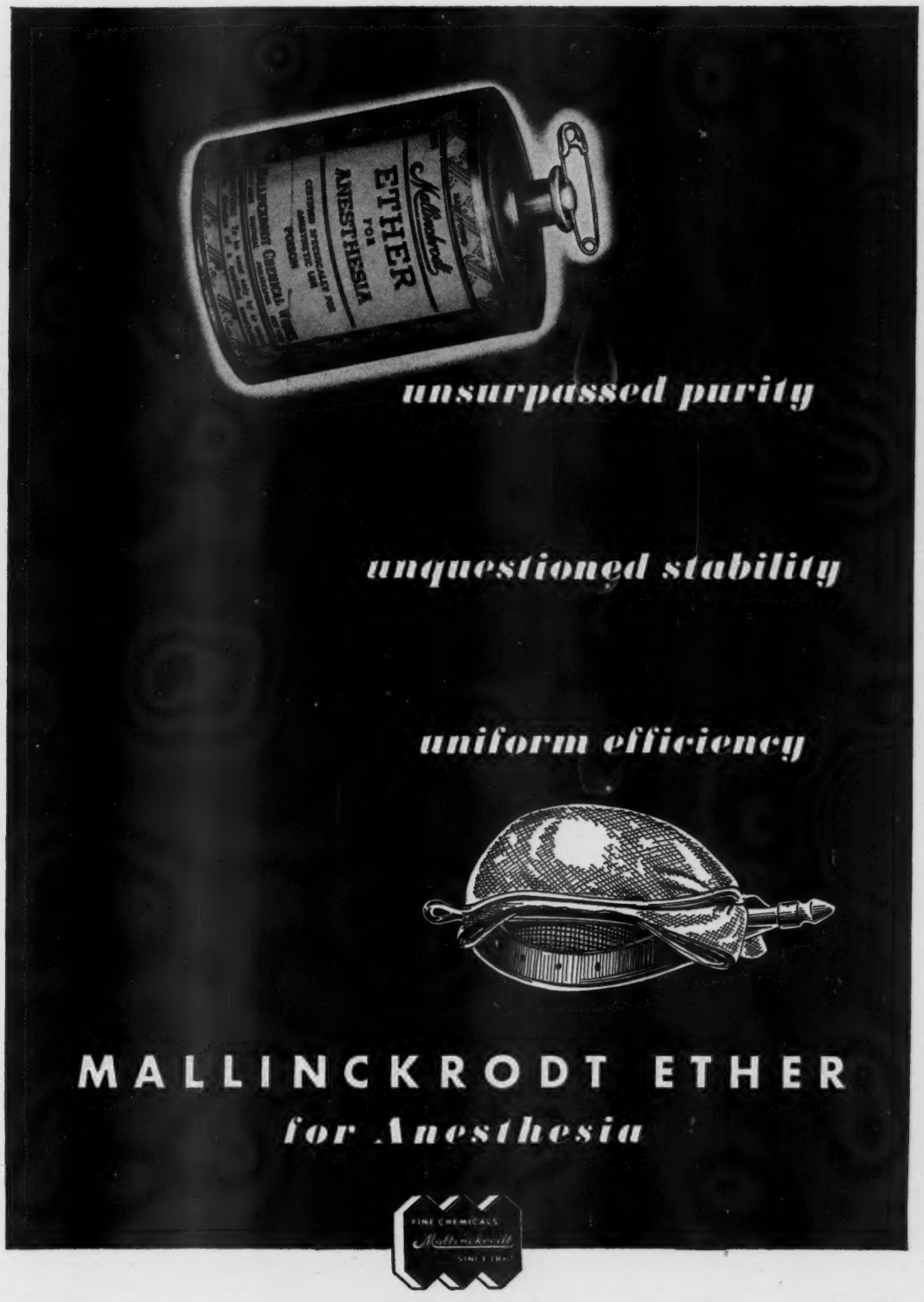

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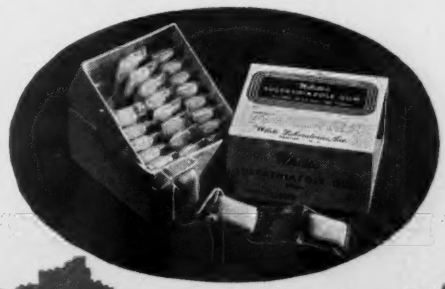

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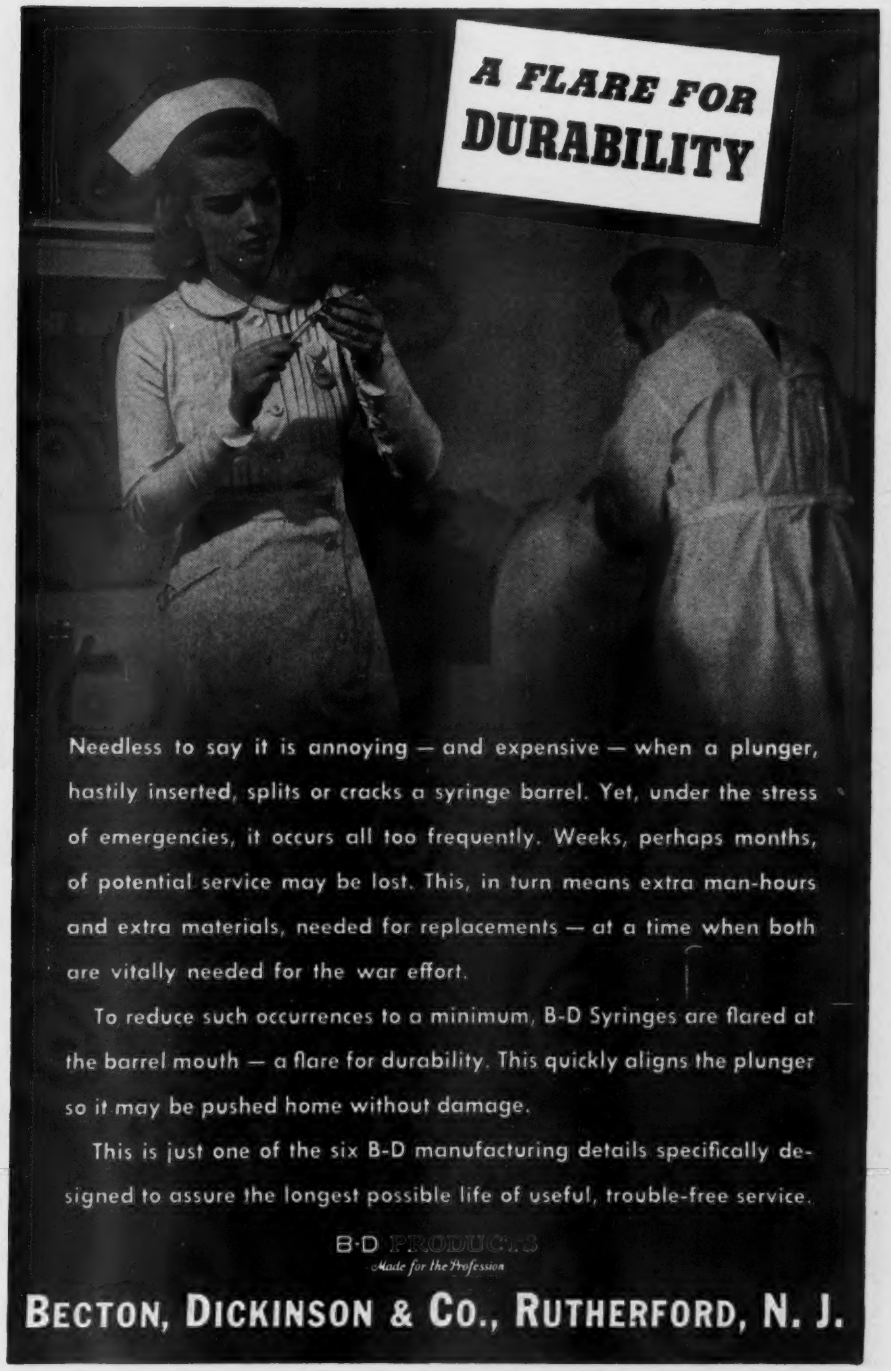

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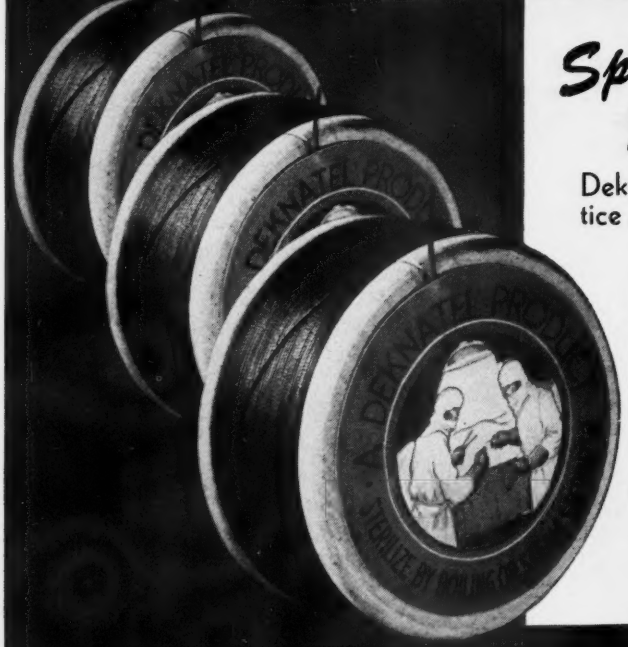

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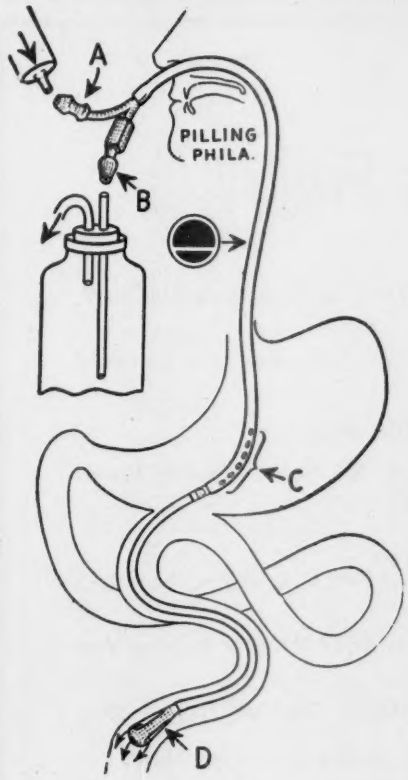

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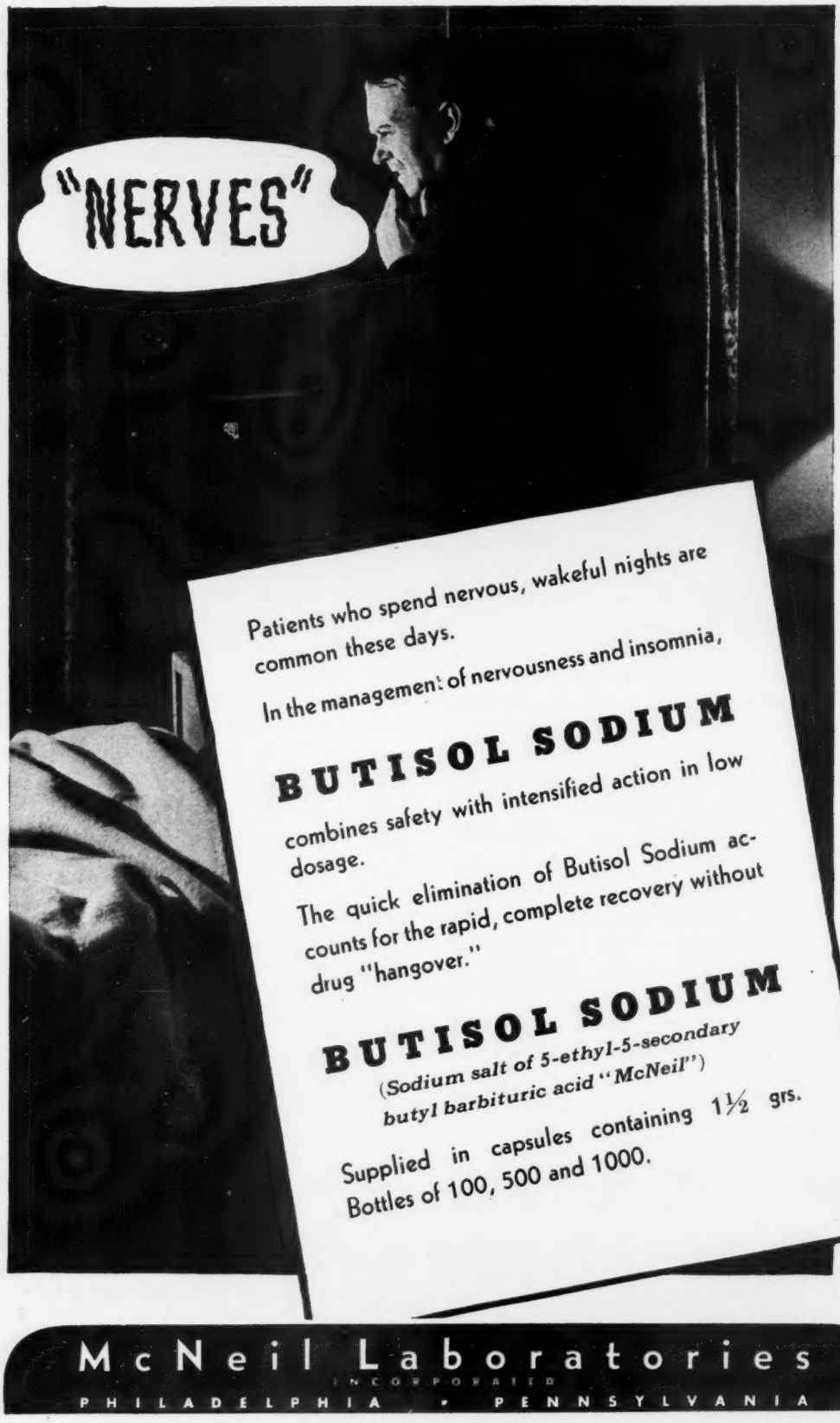
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IN THE PREVENTION OF

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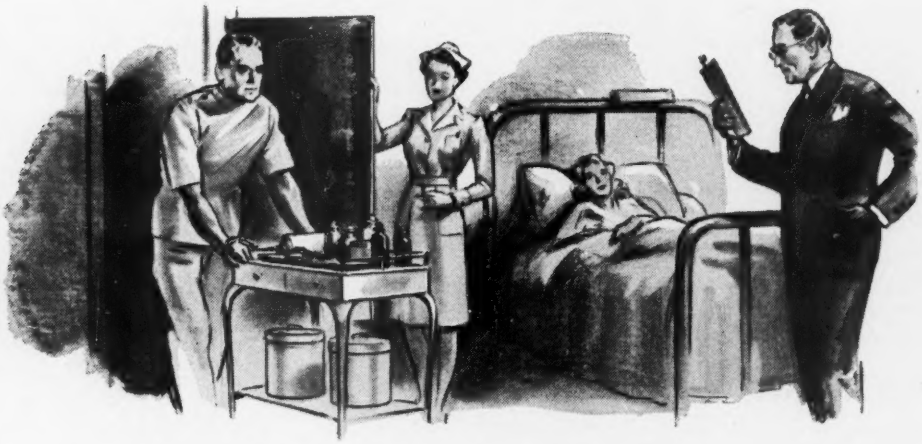

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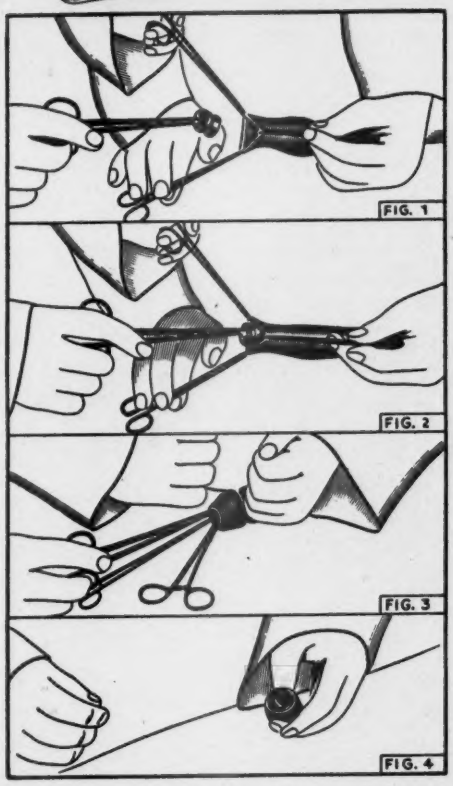

OPERATING TECHNIC
ROSS CIRCUMCISION RING

FIG. 1. Introduction of instrument.
FIG. 2. Introduction of instrument.
FIG. 3. Firm application of ligature.
FIG. 4. View of penis with instrument held firmly by ligature. The prepuce has been excised just distal to the ligature.

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*Ref. Cecil J. Ross, M. D., New Circumcision, Western Journal of Surgery, Obstetrics, Gynecology, Dec. 1940; Circumcision by Ligation, Northwest Medicine, May 1942.

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The American Journal of Surgery

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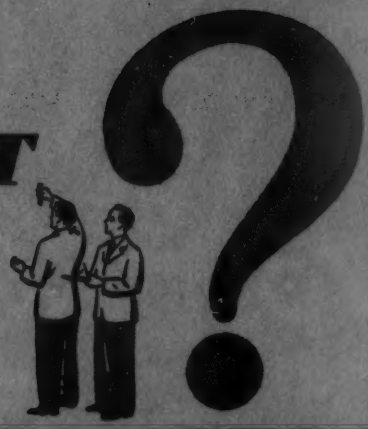

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